THE

ELECTRICAL REVIEW.

VOL. LXIII. DECEMBER 18, 1908. No. 1,621.

ELECTRICAL REVIEW

Vol. LXIII.] CONTENTS: December 18, 1908. [No. 1,621.

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Published every FRIDAY Price 4d.

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OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGRIKAY, LONDON." Code, A B C.

Telephone Nos. Holborn 963 Central 4425 (Editorial only).

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FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London), to be made payable to MR. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1908 EDITION

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE REPORT OF THE M.T.A. SPECIAL COMMITTEE ON TRAMCAR BRAKES.

LAST week we dealt very briefly with this Report, but to-day we print it in abstract on a later page. Our only regret is that there is no room for a few of the tables and curves in which the Appendices are rich, for those relating to coefficients of friction and their derivatives are just what we have been wanting. The results are condensed from a large number of really practical experiments, and we now know with fair accuracy how the two substances in general use for brake blocks—wood and cast-iron—stand with relation to each other under all the conditions met with in general practice. The bulk of the Report lies in the Appendices, and the greater portion of those are occupied by descriptions and tests of all the well-known brakes. It is notable, however, that regenerative control is not even mentioned casually in the Report proper, nor does any description of it occur in the Appendices. The Tramways and Light Railways Association Committee did the system more justice. On the other hand, Pringle's skid brake, which is condemned in the report under the statement that the use of a purely emergency brake is undesirable, is given more room in the Appendices than any other.

The Tramways and Light Railways Association Report seemed to leave too much to the individual, and suggested that conditions varied so widely on different lines that the two brakes which did well enough for this line would be unsuitable for that. That is true enough, but we have much more sympathy with the view of the Municipal Tramways Association, which is, that there is hardly a tramway without a gradient sufficiently steep to produce a runaway under favourable circumstances, and all tramways, without exception, provide opportunities for collisions between the cars and other vehicles. The Committee suggest, therefore, that the conditions of braking, speaking generally, are of a standard character and call for standard treatment.

The two Committees agree that all motormen should pass medical and practical examinations before beginning to drive, and at periodical intervals thereafter. Both agree, too, that the use of "scotch" brakes, or "run-back preventers," is to be recommended, but this is somewhat inconsistent with their objection to the use of a purely emergency brake, as such a brake should be quite as unnecessary as any "run-forward preventer" of the same class, if any attention is paid to their other recommendations about sanding the rear wheels.

The M.T.A. Committee lays excessive stress on the incidental function of the track brake as a rail cleaner, but we should be sorry to find that all other efforts to clean the rails were dropped in favour of this. Under such circumstances, the rails of the up-hill track of a double-line would be untouched, and the use of a scotch brake would be rendered still more imperative. On the descending line, the rails would be kept clean in proportion to the frequency of the service, and it is doubtful whether the use of sand, which the Committee want to abolish ultimately, could be avoided on lines where the headway is long.

The Report is rather hard on purely magnetic brakes, undoubtedly as the result of the experience of the Committee, but it is not fair to hold up as a disadvantage that the driver cannot tell until the car is under way whether the

brake is available for action or not. This is of no importance when the brake is used for service stops, as it should be, for a sudden failure between two stops would be just as likely to occur with a purely mechanical brake. We do not desire to uphold the purely magnetic brake against the combined magnetic and mechanical brake, for the advantage of being able to start from rest down a steep or a long grade with the track brake set, is most important.

It would be wrong to coast with the magnetic part of the brake, and to regulate with the mechanical part, for in the event of the failure of the electric circuit at the top of the hill, it might be, and probably would be, impossible to bring the less powerful mechanical action into use until the speed had reached a point at which the brake would be useless, owing to the reduced coefficient of friction. Under such conditions, no wheel brake would be of any avail, as a long series of disasters has proved, and it is to meet such a case that the purely emergency brake is wanted.

In this matter we are beginning to feel uncomfortable from the pressure of external opinion, as the Tramways and Light Railways Association report hardly granted the emergency brake the right of consideration, while the Municipal Tramways Association report agrees with Col. Yorke that the use of such an appliance is undesirable. It must look like an exhibition of something approaching mere obstinacy to continue to hold a contrary opinion in the face of such unanimous disapproval, but we have not yet seen any arguments which traverse our position, and until that happens it does not seem necessary to display the white flag.

Again, with reference to the carefully considered judgment of the Municipal Tramways Association Committee that the wheel brake should be retained, we cannot say that the case presented is convincing. Everyone knows, and we have always maintained, that any car may be taken in safety down the steepest grades on our tramways under the control of the wheel brakes alone so long as the brakes are in good order, the rails reasonably clean, and the driver capable. Everyone knows, too, that the wheel brake is not the only form which can cause skidding. But are these reasons sufficient? What of the other side of the question? In the first place, we find that both Committees recommend two brakes per car. Is each of those brakes to be powerful enough to stop the car by itself in case of accident to the other? Surely that is the only sensible inference. Then let us ask point blank, Will the Committee recommend the use of the wheel brake for this purpose?

Secondly, seeing that runaways only happen on the flat, or when the brakes are out of order, or the rails greasy, or the driver careless first and panic stricken after, or through a combination of these causes, is it wise to retain the services of a brake which must be used with the extremest care to prevent it throwing out of action other brakes which are more capable of controlling the car under all conditions?

Thirdly, is the Municipal Tramways Association Committee really in earnest when it uses as an argument in favour of the wheel brake that it is not the only brake which may cause skidding?

Now that the Municipal Tramways Association unconsciously has exposed the weakness of the case for retaining the wheel brake, we are the more convinced that it is a positive source of danger upon any line where grades are steep or long, and it ought to be superseded by some form of power brake for service use. What happens to the car when the motorman locks the wheels in a panic, and what will happen when the best motorman in the world finds the coasting brake ineffective and flies to the wheel brake for protection when the car is travelling already at a speed of 15 M.P.H. on a greasy grade of 1 in. 12?

At the time when the magnetic combined wheel and slipper brake first came into use in competition with the magnetic track brake pure and simple, we were constrained to favour the latter because the control of the wheels by the first was as yet uncertain; but this objection has been met and overcome, and both Committees find that form of magnetic brake to be the best for general purposes.

There are several brakes of this type on the market, and all can be fitted with the auxiliary mechanical action which is necessary, if only for the purpose of holding the car against gravity.

Perhaps the most interesting, because the most controversial feature of the Municipal Tramways Association Report, is the stand taken in favour of cast-iron as the material for track brake blocks. It is admitted that the coefficient of friction of cast-iron on dry rails is much lower than the corresponding coefficient for wood, but the average condition is the proper one to take for generalisation, and for wet, dry or greasy rails the cast-iron block gives higher results than the wood block, and on a greasy rail it is far better than the latter.

The Tramways and Light Railways Association, on the other hand, think the wood block the better, and would like to see magnetic slipper brakes formed partly of wood.

The Municipal Tramways Association certainly went into the question most carefully with the aid of a multitude of experiments, and an examination of their tables and curves is alone enough to condemn the use of wood blocks, as they are utterly inadequate on a greasy rail, being unable to hold a car on a grade of 1 in 27 when the blocks are pressed against the rails with 4 tons pressure.

We attach great importance to the recommendation of the Committee that the efforts of inventors should be directed towards the design of a brake which, in the event of failure in the ordinary method of application, would be applied automatically, and, we may add, at full power. There are enormous difficulties in the way, but the production of such a brake, containing in itself the true emergency function, which, for want of better means, we wish now to see performed by an independent mechanism, would set at rest the necessity for such discussions as the present one.

However we may disagree on certain points with the authors of the two Reports, we are certain that inestimable good will come in one form or another from their labours, and that one of the most tangible proofs of this will be found in the growth to still greater insignificance of the ratio of passengers killed to passengers carried, now standing at 1 : 183 millions.

The P.O. and Wireless Telegraphy.

The opening of the first wireless telegraph station of the Post Office for commercial purposes on Friday last marks an epoch in the development of the State telegraph system. Curiously, it synchronised with the holding of a public meeting at the Mansion House to advocate the State ownership of the submarine cable system—but this is another matter, with which we deal elsewhere. The Post Office has, of course, displayed a very practical interest in wireless telegraphy ever since the advent of Mr. G. Marconi, and has already two installations, one of which—that at the Wash—was described in our issue of February 8th, 1907; but these were more or less experimental, and were not intended for public use.

It will be observed that the Post Office has now entered the field of wireless telegraphy, not exactly as a competitor with the Marconi Co., but rather, as in the case of the telephones, as a collaborator with the existing concerns, and with a view to asserting its suzerainty over all manner of telegraphic communication systems.

The difficulties and deficiencies of wireless telegraphy were fully acknowledged by the Postmaster-General in his opening speech; he pointed out, however, that the erection of the station was in conformity with the obligations imposed upon the Post Office by the Radio-Telegraphic Convention, and it is both interesting and significant that he was able to add that the Marconi Co., formerly so hostile to the Convention, now supported it. Taken in conjunction with certain changes in the *personnel* of the company, this statement will readily be interpreted by those who have kept themselves *au fait* with the inner workings of the wireless telegraph world. Mr. Marconi himself sent a message of congratulation and good wishes to the Postmaster-General.

There is one feature of the proceedings which appears to us somewhat singular. The opening ceremony was well advertised in the daily Press, and we have noticed in the official accounts of the station thus published that while the names of Mr. Buxton, Sir H. Babington Smith (secretary to the Post Office), and Lieut. Loring

have received a sufficient measure of publicity, the engineering staff of the Post Office, which we should have thought would be responsible for the design and supervision of the installation supplied by the Marconi Co., is barely mentioned. From the *Times* report of the proceedings at the opening ceremony, we gather that the Engineering Department was represented at that function only by one official, Mr. Robb. We may be mistaken in our inference, but it certainly seems as though the Engineering Department had been left out in the cold.

The Status of an Engineer.

An article elsewhere in this issue raises, not for the first time, the question—What constitutes an electrical engineer? There is no doubt that the title is sadly abused; as our contributor points out, anyone who dabbles in electrical work, no matter in how small a way, is able, rightly or wrongly, to arrogate to himself the style of electrical engineer, without hindrance from any quarter. Cannot the Institution of Electrical Engineers do anything towards putting an end to the unauthorised adoption of the title? We have observed the efforts made by the Institution during recent years to raise the status of its members by elevating the standard of the qualifications required of candidates for Membership and Associate Membership, and were glad to learn recently, on the authority of Prof. Kapp, that an examination test was under consideration with the same end in view; but these steps affect none but the actual or would-be members, and in no way mitigate the abuse to which we have referred.

It is not only electrical engineers who suffer in this way; the generic term of engineer itself is widely misapplied. For instance, the Amalgamated Society of Engineers has not the faintest claim to that title. Just as an engineer is not necessarily a mechanic, so is a mechanic not necessarily an engineer, and in point of fact the members of the A.S.E. are mechanics not engineers.

It is interesting to note that in the Institution of Civil Engineers, the *doyen* of all engineering societies, an agitation is on foot—a recrudescence of a grievance which has rankled for years—with the object of raising the status of the engineering profession, and a committee has been formed, with Mr. A. S. E. Ackermann as hon. secretary, for the purpose of compelling attention to the urgent necessity for reform, not only in this respect, but also in connection with the general policy and administration of the Institution. Discontent has been rife for years past amongst the rank and file of the Institution, if we may so designate the great body of Members and Associate Members who form the mainstay of the society, and has now assumed an active form. Judging by certain passages in the inaugural address of Mr. J. C. Inglis, it would appear that the President himself is favourably disposed towards the reform which is so greatly needed, and if this is so, the probability of success is greatly increased. We believe that a somewhat similar movement is on foot in connection with the American Society of Civil Engineers, and it would appear as though there were a general feeling that the profession of engineering ought to be placed upon a par with the older professions not only as it is, *de facto*, but also *de jure*.

Cable Reform.

The Lord Mayor's meeting on Friday would have the effect of drawing attention to the strong support behind the question of "Cable Reform," which is a title now becoming well known as referring to proposed alterations in the present service. Beyond the information already published, three points were made by Sir Edward Sassoon and other speakers, viz., the sound financial condition of the State-owned cable across the Pacific; the rapid re-adjustment of earning power consequent on the reduction of the Indian rate, and, lastly, the reduction of rates and the initiation of "deferred" messages, in such a manner, while preserving the interests of existing companies, as will popularise and make more generally useful telegraphic communication throughout the British Empire on a paying basis.

We have, therefore, had a statement made that a State can work cables profitably and that the equilibrium of revenue follows reductions, and the question arises as to how far further reductions and the placing on lines of a new source of "deferred" traffic can be met in justice to all. With regard to the latter "open" question, we think it would not be to the benefit of companies to defer the consideration of the utilisation of lines for this class of traffic wherever possible, and we think the next step should be the consideration of how far it would be possible for the State and companies, if they will, and if not the State alone, to combine and devise the new lines required for traffic which companies cannot carry, and do not desire to provide capital for. This work would be in the nature of building up to requirements, and the calculation of the number of new lines wanted at the present moment seems to be only a waste of time, as they can only be determined by future exigencies. But we shall refer to the whole matter at greater length in our next issue.

Meters for Trams.

Mr. C. J. Spencer discusses this question in the *Tramway and Railway World* for November 5th, and arrives at a conclusion, based on his own fairly large experience, and on the results reported or rumoured from Germany. He condemns the time-meter, which we had reason some time ago to hope might find favour with British managers, and he is about to equip all the Bradford cars with ampere-hour meters.

We never supposed that the time-meter, *i.e.*, the meter which records simply the time during which current has been used on the car, could be as valuable as a meter which records the true value of the energy or the ampere hours, but at the time of our writing no manager would have faced the expenditure necessary to equip his cars with those meters, even if they had been reliable or long-lived, which they were not. Under those circumstances we were bound to press on the notice of managers the simple, cheap, and reliable instrument consisting of nothing more than an electrically-controlled clock, by which a definite, if not a complete, check could be put on the individual driver, and even now we are not convinced by Mr. Spencer's arguments in favour of a more elaborate instrument, that the time-meter will not do very nearly as much as he needs, at a smaller cost and with less trouble.

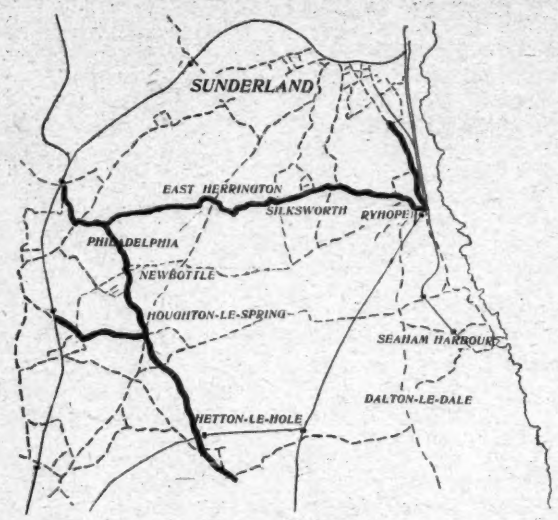
The true value of the current quantity used is, of course, of considerable value for indicating the deterioration of the electrical portions of a car, and it would be almost impossible to compass this end by means of the simpler instrument, but as a means of checking bad driving or mechanical (*i.e.*, frictional) faults, it is difficult to see in what particulars the ampere-hour meter is of much more value than the other. Let us, however, acknowledge Mr. Spencer's continuous labours to produce better results from his men and machinery, and congratulate him most sincerely on adapting an instrument of accuracy to the rough service of the tramcar.

In Bradford the cost of energy comes to 28 per cent. of the total working cost, amounting in money to about £45,000 per annum, so that the judicious expenditure of, say, £1,000 on the interest on and up-keep of meters on all cars might very soon show a good return. Already about half the cars have meters and on the routes where these cars run, the energy consumption has decreased from 7 to 15 per cent., whereas the consumption on the unmetered routes remains as before.

It will be easily understood that drivers who are put on their mettle by this means will not tolerate any defect in the equipment which will tend to run up the meter records against them, and in this way the efficiency check is extended from the front platform of the cars to the sheds and repair shops. We have never come across a sustained effort to reduce current consumption which did not prove how much something of the sort is required, and it is a source of considerable disappointment that the earnestness with which we have urged action in the matter has met with so meagre response. Perhaps Mr. Spencer's success will act as a more potent spur to the men whom we have been trying to reach.

SUNDERLAND AND DISTRICT ELECTRIC TRAMWAYS.

The Sunderland and district electric tramways, which were constructed under a provisional order of the Board of Trade granted to the United Kingdom Tramways, Light Railways and Electrical Syndicate, Ltd. (whose powers were subsequently transferred to the present company—the Sunderland District Electric Tramways, Ltd.) have now been running for some three and a half years. The system covers an important part of the North-Eastern section of the county of Durham, for within its area are included a number of large collieries and populous urban areas, as well as wide stretches of agricultural land, and over the greater part of the district the railway service is inadequate, as the stations are one or two miles away from the populous centres and even further off in the case of the agricultural parts. The population of the district served by the tramways is close upon 100,000, but it is very scattered, and the system has been found to be a great convenience. Owing to the relative positions of the tramways and the railway they are each spared that competition that is often so keen, and are mutually beneficial, the one serving, to some extent at least, as a feeder to the other.



Plan of Routes.

The system was opened in June, 1905, after being under construction for a considerable time. The track, which is single throughout, with pass-by loops, is 14½ miles in length, and stretches from Houghton-le-Spring to Easington Lane in a south-easterly direction, and from Philadelphia to Grangetown in an easterly direction; short branches run from Houghton to Fence Houses Station, and from Philadelphia to Penshaw Station, while the railway is again tapped at Hetton-le-Hole. Starting from Houghton-le-Spring the main track passes through Newbottle, Philadelphia, the Herringtons, Old Silksworth, Silksworth Colliery, Ryhope Colliery—close to the coast—and Grangetown. Here the lines reach the Sunderland borough boundary, where the district lines terminate and those of the Sunderland Corporation commence.

The contract for the construction of the tramways was placed with Messrs. Bruce Peebles & Co., Ltd., Edinburgh, by whom the work of laying the permanent track was sub-let to Messrs. Krauss & Son, of Bristol. The track is built to 4 ft. 8½ in. gauge, with 90 lb. rails laid upon a foundation of concrete. A good deal of trouble was experienced in laying the track, owing to the inequalities of the roads caused by subsidences resulting from the mining operations of the district. The same trouble operates still, and necessitates constant vigilance on the part of Mr. G. Stratton, the chief engineer and manager, and his staff. Several railway crossings—connecting the collieries with the adjacent railways—had to be dealt with, and at the Lambton Colliery at Philadelphia a special crossing was put in of manganese steel, in two castings, so that the railway lines are in one piece for the whole length of the crossing, the joints being on the tramway section. The crossing was constructed by Messrs. Edgar Allen, of Sheffield, and was laid on heavily creosoted timber. In the course of the track there are some very sharp curves, which at places are difficult to negotiate owing

Typical Street Views on Sunderland and District Tramways.

to the narrowness of the roads. Prior to the completion of the track, structural alterations had to be made to a bridge which carries the Hetton Colliery lines over the highway to the south of Silksworth.

The overhead equipment was supplied by the British Electric Equipment Co., of London, the system adapted being side poles and brackets.

Originally power was supplied by the company themselves, who utilised gas engines to drive Bruce Peebles dynamos, but this from the character of the demand was not a satisfactory arrangement, being entirely lacking in elasticity, and not capable of being manipulated to meet the exigencies of the moment. Latterly the routes have been worked from the Durham Collieries Electric Supply Co., whose generating station is close to the Tramways Co.'s car-sheds at Philadelphia. The current is carried to the Tramways Co.'s switchboard, whence it is regulated to meet the traffic requirements.

The rolling stock of the company consists of 15 cars of French construction, with top covers, 15 double-deck Brush cars fitted with wind shields, and three Brush cars of the Brill-truck, double-deck, top-covered type, this type having been more satisfactory in use.

All the necessary repair work is now being done by the engineering staff at the car-sheds at Philadelphia, with the sole exception of the rewinding of the armatures, which work is done under contract. At first some difficulty was experienced in refitting tires on to the car wheels, but this has been overcome by a rather ingenious contrivance. A Bunsen burner of sufficient size to equally heat the tire was made, and, as there is no gas supply in the district, it was necessary to generate some, and this is obtained from petroleum. The oil is passed into a heated chamber, and when it enters the delivery pipe it is mixed with air, which enters the pipe at a pressure of between 70 and 90 lb. This arrangement has been found to work quite satisfactorily, the tires being expanded in from 20 to 30 minutes.

The tramway company has taken up a contract for the public lighting of the road between Newbottle and Penshaw station through the local Councils. The supply of electricity is drawn from the overhead equipment, and each light consists of five 24-c.p. tantalum lamps in series.

With the object of popularising the service, the company on occasional days during the school holidays conveys two children free with each adult, and the system has been found to work well.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Peat.

I was much interested in your Editorial remarks on the above subject, as well as in the abstract you gave of Mr. Tomlinson's address delivered in Dublin last month.

I am not acquainted with the bog conditions in Ireland, but I have practical knowledge of peat getting and drying in the peat bogs of the Scottish Highlands. As a matter of fact, I have cut the peat and laid it out for drying, and have assisted in every other process, even to building the peat stack. Hence I can thoroughly credit Mr. Tomlinson's figures as to the amount of moisture contained in peat as dug out of the bog.

Of course, the quantity of contained moisture varies with the quality of the peat. There are certain bogs, and, sometimes, certain sections of the same bog, where what is colloquially known as "black peat" may be obtained, and this peat contains much less moisture than the average brown peat.

It also dries into a hard, heavy mass, and is looked on by the Scottish peasantry as fully equal to coal for fuel purposes.

I am pleased to observe that Mr. Tomlinson has come to the conclusion that success can only be obtained by an adaptation of the present methods. In fact, I may say it is scarcely even an adaptation, because if one examines any Scottish peat-bog it will be found that it is intersected here and there with cuttings, and that the effect of these intersecting channels is precisely what Mr. Tomlinson aims at. All he suggests doing is to carry the present method one stage further and make the sub-divisions of less cubical content.

As to drainage: this is a most important point. It will be invariably found that there is a good deal of natural drainage going on, as there are small streams which flow out of the bogs and so carry off the surplus water due to rainfall and the natural shrinkage of the bog mass, but this is not sufficient. Might I suggest that several windmill pumps could be used to pump up the drainage water from the lower level cuttings in the bog, so that there would be less necessity for cutting a deep drainage canal through the lip of the containing saucer. Our Scottish moors generally have wind enough and to spare for many windmills.

John D. Mackenzie.

Glasgow, *December 8th*, 1908.

Combined Track-Circuit and Cab-Signalling.

The writer of the article on the above subject has honoured me with such a lengthy reply in your issue of the 11th inst. that I must venture to ask for a further portion of your space.

If I may refer to the final paragraph of his communication first, I am glad to learn that the writer believes "Cab-signalling has a great future before it." I was afraid from the tone of the article which has given rise to this correspondence, that he looked upon it as a pretty device, but impracticable. I apologise.

I gather now that it was mainly against the idea of cab-signalling entirely and all at once superseding everywhere the present in many respects admirable system of outside semaphores, that the writer desired to raise a protest. No one expects such a transformation outside of fairyland. It is not practicable, and in Capt. Gardiner's exposition of his proposed system the fact was recognised, and the model showed the two classes of signals working in conjunction. Personally, there seems to me to be great objections to requiring a driver to attend to two sets of signals, one outside his cab and the other inside it, and such an arrangement would, I conceive, only as a rule be admissible during the installation of a change of systems, or under some special circumstances.

I am afraid in this age of progress railway administrations cannot rest upon their oars and contemplate their unquestionably excellent achievements for any length of time; and as regards risks, they are, no doubt, accepted every day by travellers and others, but that does not remove the necessity and expediency of minimising such risks wherever reasonably practicable. One of the graver risks in connection with railway travelling at present, is the risk of the failure to obey a signal, and Capt. Gardiner's train control is largely directed against this.

As regards the humans who work our trains with marvellous safety, for which they deserve all honour and credit, I quite agree with the remark "give men all the help possible to check their liability to error, or to know what is required of them, and leave them to do the rest." The idea expressed in these words is, I think, the mainspring of the system of train control proposed by Capt. Gardiner.

The writer of the article and myself still seem to rather misunderstand one another on some points. I have not questioned the necessity for brain and manual control where the setting of machinery, &c., has to be altered to meet varying and irregular conditions. What I deprecate is its introduction where the apparatus has always a definite purpose to perform automatically.

Capt. Gardiner will, doubtless, in due time be given an opportunity of replying himself to the criticisms of his proposed system. Personally, I do not follow the writer's objection to signalling *in the rear*. Signalling in the rear of a point of danger, that is, in the front of any train running into it, would seem to be generally what is required for double-line working. Track-circuit signalling and train control, such as Capt. Gardiner proposes, adapted to the case

of single-line working, would give indications both in front and in rear of a train.

I, at present, fail to understand what difficulty there really is in applying Capt. Gardiner's track circuit and cab signal to the simple junction illustrated, nor, may I add, do I follow the difficulty in its application to much more complicated junctions and yards. It seems to me that two different matters are rather mixed up. It is, no doubt, a more or less complicated business to set the selected road through a yard or junction intricate or simple, and having done so to protect the same properly, but when that has been done (and it is done thousands of times daily), and only then, to give the signal to the particular driver intended to come on (with or without limitation of speed as may be necessary) is another matter, and I do not follow why, inherently, there should be more difficulty in giving it in the cab rather than by an outside semaphore, once a controlled current in the cab of the engine has been established.

It was not considered desirable to introduce into Capt. Gardiner's model any more of the problems of railway working. Sufficient was thought to have been shown to establish the adaptability of the proposed system to various situations. As it was, a criticism frequently expressed was that the model did too much. Even the details introduced unavoidably gave the impression to the non-expert observer of a multiplicity of electrical apparatus being required, and it was not desirable to accentuate a wrong impression, it not being practicable to make the model appliances proportionate to the scale on which the track itself had to be built.

As a railway administrator concerned in dividends, believe me, I do not at all look upon "scrapping" with a light heart, but I am afraid improvements cannot often be carried out without "scrapping."

The question at present seems to be, will combined track circuit and cab signalling conduce sufficiently to additional safety and to the increase of the transport capacity of a line, to make the new departure worth while adopting, even though "scrapping" is involved? So far as track circuit working is concerned, the extent to which it is being already adopted seems to answer the question in the affirmative, and the point now left for settlement would appear to be: should the track circuit work its signals and control in the cab of the engine or through an outside semaphore and outside device? I assume it may be accepted now that either method is practicable.

The outside semaphore will, at any rate, die hard; it holds the field to start with. I will not venture to prophesy which system will, in the end, be the victor. From the further exposition of the views of the writer of the article given in his last communication, I gather he is disposed to back the cab signal. Perhaps he is right, certainly the cab signal system seems worthy of being given a practical trial on a suitable track of railway.

R. Gardiner,
Lt.-Col. R.E. (Retired).

London, S.W., *December 14th*, 1908.

Inspection of Mines and Factories.

In your leader in your current issue you strongly, and I submit most wisely, advocate inspection of wiring, &c., in mines by electrical inspectors.

Why stop at mines? Surely the various factories and workshops using electricity are as important in many ways as mines, and should, therefore, be inspected as frequently and carefully. It will be agreed that the present staff of Factory and Mining Inspectors is unable from lack of time and qualifications to undertake this work, and, therefore, another body will have to be appointed which, to do the work thoroughly, will require to be almost as large as the present staff, and will entail on the taxpayer a rather heavy extra contribution to the revenue.

Most factories, workshops and mines using electricity as a motive power have already an electrical inspector visiting them three or four times a year for insurance purposes against breakdown, &c., who makes tests himself (H.M. Inspectors could not think of carrying a "megger," and would require a motor-car probably). Reports and recommendations are sent in to the owners as to increased safety, and also suggestions as to increased efficiency. (H.M.I. would presumably have too much to do with the "safety" to trouble about efficiency.)

I think I shall be right when I say that the present system of boiler inspection, where the inspector and his company are responsible agents to the Board of Trade, in that the "thorough" and even "working" reports have to be signed and kept for reference in the "register" provided, is a success, as boiler explosions are now very rare, and the cost is borne, not by the country, but by the individual gainer by the inspection, *i.e.*, the owner, who is compensated in case of accident.

Unlike H.M.I., the boiler inspector is not an autocrat, as an owner has the choice of several companies of good standing, and if he suspects he is not being fairly or considerately treated having due regard to the circumstances of his case, he can take his business elsewhere. This tends to check any extreme demands, which, unfortunately cannot, I think, always be said of H.M.I. of Factories.

A short Bill in Parliament on the lines of the various Boiler Explosions Acts would, I submit, meet the case for electrical inspection, as the staff is already created and has been at work 10 years or more.

May I also point out that the insurance companies' inspectors are practical electrical and mechanical engineers, and chosen as such. They are not men with social influence with the "powers that be," put, for form's sake, through an examination which any public schoolboy could pass easily.

In conclusion, let us, by all means, have competent inspection by independent parties, but save us from another set of inspectors, who only benefit (?) the owner by hauling him before the "beak" for trivial technical breaches of obscure rules, and require as much running after as a vain girl.

P. A. D.

Electrical Fatalities in Collieries.

Having had eight years' experience in electrical engineering as applied to collieries, in addition to a workshop training where the manufacture of equipment, such as was then in use at pits, was one of the principal items, I think I may claim to be able to throw some light on this important subject.

To me the only cause of the accident that resulted in the death of a workman at Dark Lane Colliery, was negligence, because the management knew perfectly well that the Home Office Rules were not being carried out; secondly, the person alluded to as the "electrician" was incompetent; and thirdly, the cable system in use must be bad, and totally unsuited for a pit, otherwise the pull wire would never have been alive.

In a pit, especially along main roads, where there are usually three lines of galvanised iron wire for haulage signals, two more for telephones, besides pull ropes for runaway and junction switches, it is quite clear that if unarmoured cables are in use they must be kept under strict supervision, if accidents are to be avoided.

To my mind only armoured cables should be allowed in a pit, more especially in gate roads where falls of roof are frequent, as a heavily armoured cable, the armour being continuous and earthed, will withstand falls, and changing due to props being pushed or broken by weights coming on, and should a heavy fall occur so as to fracture the cable, the breakers or fuses operate and defy further use until the fault has been cleared.

I have been down some pits where ordinary V.I.R. cable has been run right to coal face, and in places water has been dribbling over them; and, again, where dry they have been coated with fungus, making it impossible to see the condition of insulation.

The cause of such bad systems and incompetent men being in charge is, from my experience, due, first, to cheapness. For instance, we have a man weighing sugar behind a counter, which he finds a very monotonous occupation; suddenly he thinks of an advertisement he saw in a technical paper he happened to pick up in a library, whereby he can for a small sum become an electrical engineer, and earn £5 per week (perhaps), so he decides to have a flutter. He does so, and in the meantime he gets a job as a wireman's

mate, and finally becomes an electrical engineer. He at once lashes out at every job he sees going, and thinking that 25s. per week and less hours are better than wrapping sugar, he gets the job. Some masters find him out, and turn him off; others think what a cheap man he is, and answers to the rule, as does a good man, so they keep him until some such a thing happens as at Dark Lane; then comes the final, at least we will hope so.

Secondly, I have found that those places which happen to have a good man, do not treat him properly; the man is hampered in his duty by being bossed by the person who calls himself the enginewright, who, thinking him a rival to his supremacy, does his best to make things awkward and blacken him in the regard of the management.

During the eight years I have had in collieries, I have experienced many ups and downs, most of which have been due to petty spite.

At one colliery I was successful in obtaining a high-tension three-phase job, and the manager, out of curiosity, showed me some of the applications he had received; some were tied up with blue ribbon, others were from university men offering their services for 25s. a week.

Whilst colliery owners make the enginewright and electrician compete with one another, and employ men who have had neither workshop nor technical training, we shall go on having accidents.

For my part I have left collieries. There is naught but hard work, long hours, and usually bad surroundings. If it is not worth 50s. per week (£2 10s.), I say let them go on having their cheap men and bad systems, and keep on paying £300 as compensation. Perhaps it will dawn on them one day.

If the Miners' Association took the matter up and refused to let their men work where incompetent men are employed, we should soon have an alteration; pressure could be brought to bear on Parliament to appoint qualified inspectors on their merit and not by influence.

In conclusion, I am pleased to see that such a valuable paper as the REVIEW has taken the matter up, and that they are endeavouring to bring home to colliery owners the necessity of having the right system, and men responsible to them for the proper usage of their electrical equipment.

Ex-Colliery Electrician.

Which is the Rational Method of Stoking?

Your correspondent "Radix" is quite right in pointing out that underfeeding is not new; our stoker catalogue gives the history, showing that underfeeding in England dates from 1846, but that no commercial success was attained till 1901, when we introduced Erith's grateless underfeed stoker, which still differs from all other firing methods in having no grates whatever.

In your issue of November 20th, "Radix" criticised underfeed stokers with grates, but in your issue of December 11th he states that at Burnley Electricity Works the flame often reaches the end of the boilers before combustion is complete.

He does not give any authority for this singular statement, but he is probably aware that the coal cost at this plant is only 0·29d. per unit—although the boilers in question are old 7 ft. diameter Lancashire boilers with only 33 in. furnaces and no superheat; this fuel cost does not indicate much scope for improvement of combustion on such a plant, especially as the fuel used is high-priced for Lancashire.

"Radix" may not be aware that in 1903, four Erith's grateless stokers replaced two makes of overfeed stokers there, and that the then engineer's published report certified 33 per cent. increase of steaming duty, 12 per cent. coal saving, and no smoke; and that in consequence, six more grateless stokers were fitted in 1904, and these 10 grateless stokers, after five years' work with only trifling repair charges, only need to be converted to our present system of *automatic* control of fuel and air in order to equal in efficiency our latest pattern, which on recent independent test, showed an average of no less than 16 per cent. CO_2 and no CO, and no smoke. As there are over 6,000 of Erith's grateless stokers in actual work throughout the world, it is quite easy for "Radix" or anyone interested to see how they compare with any other firing method for simplicity, durability, range of fuels, smoke prevention and efficient combustion; but to confuse these grateless stokers with stokers using grates, as "Radix" does, is only misleading.

Erith's Engineering Co., Ltd.

London, E.C., *December 14th*, 1908.

Cheap House Wiring.

Referring to your article of last week on this subject, I venture to think that you will agree that the cost for installing electric light in a private residence usually amounts to a sum that is only within the reach of those in receipt of an income much above the average of the middle classes. Especially so, if metallic-filament lamps are used. Now, I think that those who support this system of lighting are of the opinion that the benefits derived from electric light should be enjoyed by every class, and that if the charges for installing the same can be brought within their reach, it will not only be to their advantage, but the supplier and contractor will benefit in turn.

With reference to your argument that this system of surface lighting would be unsafe for shops, &c., I would point out that such a complaint can hardly be classed under this heading, as the object in view is cheap house wiring, and it does not necessarily include shops and factories.

While in Germany a few weeks back, I noticed that the rules governing the wiring of private houses were different in several respects to those governing the wiring of factories and shops. Flexible wire and insulated staples are used on the ceilings, but where the flexible comes within reach, conduit is made use of. As an instance, it was pointed out to me that it was compulsory to use conduit, or some such covering, from the turn switch to the ceiling, so that your proviso: "That switch wires laid on the surface of walls need some kind of protection," is in accordance with the ideas of those where surface wiring reigns supreme.

A gentleman told me quite recently that he had secured an estimate for installing electric light in his house, and that it amounted to the sum of sixteen pounds (£16), an outlay that he did not feel prepared to meet, so he had the same number of gas lights installed at a cost of six pounds (£6); I think that this is the experience of many. Such high charges retard the extension of electrical supply. Further, in conversation with the engineer of the installation department of a corporation in the North of England, he told me that his department had reported a deficit each year, because the estimates given by the borough engineer were invariably exceeded; the fact that the supposed reasonable charges of an experienced borough engineer are often exceeded, goes to show that the actual cost of installing electric light is a costly venture. If the standard for installation work is prohibitive to the extension of electric light in the majority of the homes of England, then it is a matter for the consideration of the Institution, whose rules I trust, will be brought up to the spirit of the times.

E. C. S.

London County Council Turbines.

From the issue of your valued paper, dated November 17th, I notice that the London County Council have ordered from Messrs. The British Westinghouse Co. two 5,000-KW. turbo-generators for their Greenwich central station, these turbines to be Rateau machines. It is interesting to observe that a manufacturer has been entrusted with this important order, who adopts such a radical change in the type of machine as that represented by the difference between an impulse turbine with a set of blade wheels, and a reaction turbine of the drum type. In your paper it was stated that the London County Council engineers preferred Rateau turbines after they had seen one of these running at Milan. It would appear that the London County Council therefore expects to

receive for its central station at Greenwich, turbines built on the lines of the machines seen in that city.

Permit me to draw your attention to the fact that the 2,500-KW. three-phase turbo-generator which came into beneficial use at the City of Milan Electricity Works in the spring of 1906, is a machine built and supplied by the Maschinenfabrik Oerlikon, of Switzerland, and that the central station authorities have expressed their great satisfaction with this machine, by ordering another unit of the same type, but of 3,500 KW. output. This latter machine has just been delivered.

The Maschinenfabrik Oerlikon has secured from Prof. Rateau, in Paris, the right to build impulse turbines, and to sell them besides in other countries, also in the United Kingdom. At a very early period, however, they got out designs, essentially different from those of the original Rateau turbine, and they developed wheels, bladings, packing boxes, thrust bearings, governors and regulating devices of their own; they were the first to build turbines of 2,000-H.P. capacity and more, with only one cylinder. Your valued paper of the 4th inst. gives a fairly complete description of the turbine now built at the Oerlikon works. These designs, to the greater extent patented by the Maschinenfabrik Oerlikon, are, of course, the sole and exclusive property of the latter, and a license under the patents of Prof. Rateau, does by no means embody the right of use of the designs got out by the Oerlikon Co.

The type of the turbine built by the Maschinenfabrik Oerlikon is, in many essential parts, altogether different from that heretofore built by Prof. Rateau and his licensees, and particularly so in connection with the larger units (Milan, 3,500 KW., Cairo, 3,000 KW., Roux-Charleroi, 2,000 KW. and Stockholm, 6,000 KW.).

The turbine inspected by the London County Council engineers in Milan, is a multi-stage axial pressure turbine, and is covered as such by the English Patent No. 24,204/98, which latter is the property of Prof. Rateau. The design of machine, as described in this patent, differs also in essential points from the machines built under the direct influence of Prof. Rateau. From these, the designs of the Mashinenfabrik Oerlikon, however, differ not only as regards the sizes already built, but particularly also by the characteristic deviations in practically all the parts of the machine. If, therefore, the inspection of an Oerlikon turbine in Milan (where, by-the-by, some time ago a Westinghouse reaction turbine was erected) influenced the London County Council in favour of a turbine named "Rateau Turbine," a similar result should have been obtained by inspecting one of the so-called Zölly turbines, as these also are of the multi-stage axial impulse type in which the steam works, according to the views of all authorities, exactly as in the Rateau turbine, and which, in face of these reflections, should apparently be called a Rateau turbine also, and therefore, fall within the same patent.

I shall be greatly interested to hear what success the makers will have with the first pure impulse turbines they have contracted to build, particularly so as they are of relatively exceptional size, and destined for the L.C.C., and, as I believe, they cannot have received the many details of design essential for success, from either Prof. Rateau or one or the other makers of this type of machine.

G. Wüthrich,
Manager.

London, W.C., *December 14th*, 1908.

INDUCTION REGULATORS FOR A.C. HIGH-PRESSURE INSTALLATIONS.

By E. B.

The facility with which electrical power can now be transmitted and distributed by means of polyphase currents makes its exploitation possible over very extended areas. The great extension of network and the losses in the line resultting therefrom cause, however, differences of pressure at different parts of the area supplied.

In installations for feeding motors exclusively the influence of these variations of pressure is scarcely felt. It is, however, highly important to maintain a constant voltage for the lighting network, and for this purpose electricity supply companies as well as engineering works have found it necessary of late years to employ apparatus for regulating the voltage of the lighting network.

When the voltage drop of these networks is relatively small, the question is settled easily by the use of transformers provided with terminals corresponding to the different voltages. This system of regulating is quite adequate, if the current used for motive power and that supplied for lighting are in the same relation in all the places supplied, and if besides all the lines are subjected simultaneously to their maximum load. If, on the contrary, the various feeders do not work under similar loads, but vary greatly, this method of regulation is no longer sufficient. It is therefore necessary to regulate the pressure of each feeder at the generating station or at the place of supply, according to the load. This can be done by means of a transformer supplied with various contacts like a battery switch, which allow of the voltage being altered by successive degrees. This system has, however, the disadvantage of regulating the pressure by steps, and therefore Messrs. Brown, Boveri & Co. have made a study of the construction of regulators with which the pressure can be changed progressively and uniformly within the limits of the regulation provided. These apparatus are well adapted for automatic control; they are made under the name of induction regulators. They can be used on single and polyphase networks, and are specially useful:—

1. At generating stations for regulating the pressure of bus-bars.
2. At receiving stations to maintain a constant voltage at the points of supply.
3. To equilibrate those phases which are loaded unequally.
4. To place high-pressure cables gradually under pressure.

These induction regulators, which are constructed in the framework of induction motors, and which are in general four-polar, form a kind of transformer, of which one element, the stator, is fixed, and the other, the rotor, is movable. It will be seen that

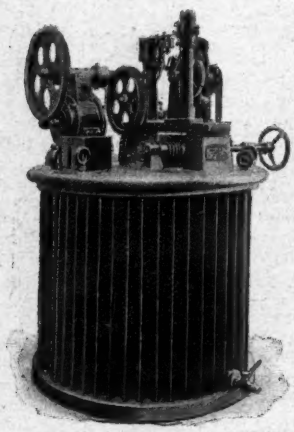


Fig. 1.—Induction Regulator Immersed in Oil.

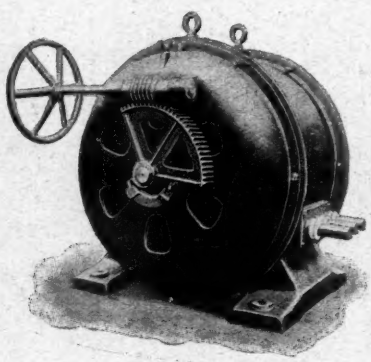


Fig. 2.—Induction Regulator, Open Type.

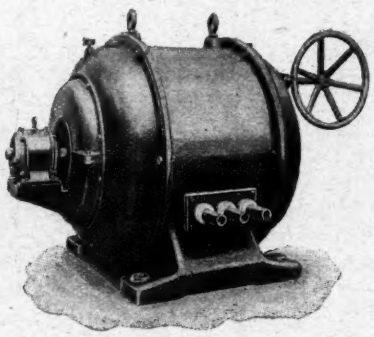


Fig. 3.—View of Regulator, showing Fan Motor.

the arrangement is practically identical with that of the well-known Cowan-Still regulating transformer.

The transformer generates an electromotive force varying in value according to the windings of the stator and rotor and their relative positions. It is maximum when the two coils are facing each other, and it decreases as they leave this position. In a four-polar design the rotor may, of course, be displaced 90°.

According to circumstances, the pressure coil may be supplied directly at the service pressure, or at low pressure by the intermediary of a reducing transformer.

The induction regulators are placed in an oil tank (fig. 1), or can be constructed as open types (figs. 2 and 3). In the latter case, ventilation is effected either naturally or with the aid of an auxiliary motor driving a fan, as shown.

The displacement of the rotor is effected by means of an endless screw, which can be worked by hand (fig. 2), or with an automatic apparatus controlled by the line current. In some cases, the above-named firm uses for this purpose the Thury automatic regulator, with which our readers are familiar.

A suitable arrangement of the relay allows of constant pressure being maintained at the place of supply for all loads and with any voltage drop. The regulating apparatus is controlled either by a special motor, or by that which drives the fan; the latter arrangement is easily made when the automatic apparatus is fixed above the induction regulator.

These apparatus are of high power factor, for they can be constructed with a very small air-gap. The loss of power in an induction regulator may be regarded practically as negligible, as it is only a few per cent. of the power passing through it, which, again, is only a small fraction of that transmitted in the line.

The great advantages which the induction-regulator offers in connection with the supply of electricity have induced many electrical firms to adopt it. Among existing installations, the regulating system adopted for the electrical supply service of Berne is worthy of mention. The Kander works, situated at Spiz, supplies the city of Berne with electrical power, transmitted by an aerial line 34 kilometres long, the pressure being about 15,000 volts. In the steam power station at Marziliinsel, the voltage of the current received is lowered to 3,000 volts to allow of paralleling with the generators of this station. On arrival at the works, the pressure of the Kander current is regulated by induction regulators to the same value as that of the bus-bars of the central station. As the relays of these regulators are compounded, they regulate the pressure according to the load.

There are two induction regulators (figs. 4 and 5) at this station, each designed for a power of 500 K.V.A. and an average pressure of 3,000 volts, which can be regulated over a range of 10 per cent.

The two regulators are mounted in parallel, and the adjusting devices are joined mechanically. They can be worked either by a switch hand-wheel, or by a Thury automatic regulator, which controls the shaft common to both apparatus. These regulators are of normal open type, with artificial ventilation.

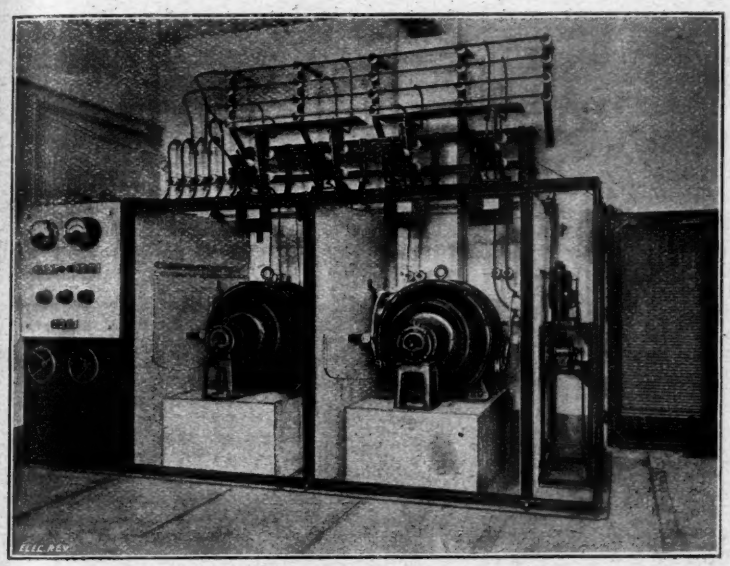


Fig. 4.—Installation of Induction Regulators at Berne.

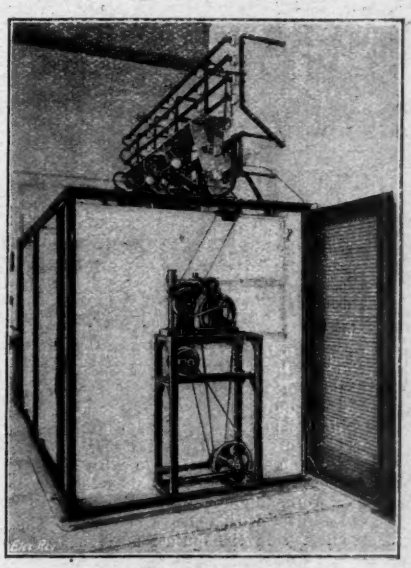


Fig. 5.—Compound Thury Regulator Controlling Induction Regulators.

Ruislip (Middlesex) Electric Lighting.—The U.D.C. is considering the question of lighting the district with gas or electricity, and has appointed a special committee to fully investigate the two systems and report upon them.

THE IRWIN HOT-WIRE OSCILLOGRAPH.

This oscillograph was invented by Mr. J. T. Irwin, to furnish an efficient and easy means of observing or recording the wave-forms of alternating or rapidly varying pressures or currents. The general principle of its action, and the early experimental forms of the apparatus, were fully described in a paper read last year before the Institution of Electrical Engineers, and abstracted at considerable length in our issue of September 13th, 1907.

The deflection of the instrument depends on the difference in the temperatures of two wires which are heated by the passage of two electric currents, one an unvarying polarising current and the other depending on the current or pressure to be measured.

The connections are shown in fig. 1, p. 1042, where C D and E F are two thin wires of the same size; one pole of a battery B is applied to D and E and the other pole of the battery is connected through two non-inductive resistances (or in some cases through special inductances) R_1 R_1 to C and F. K is a condenser in series with the wires C D and E F, and R_4 is a resistance in parallel with the condenser. It may be shown that the difference in temperature of the wires will always be proportional to the voltage across X Y when K R_4 = a certain constant; this result is independent of frequency and wave form, and of any previous voltage or variation of voltage.

The constant has been calculated for the normal hot-wire element, and is equal to 0·007. To vary the sensibility of the instrument to pressure, shunted condensers of different values are supplied, or the instrument may be shunted by a non-inductive resistance.

To show current wave forms, the instrument is shunted across an inductive resistance, or else across the secondary of a special transformer P S, as shown in fig. 2. In such cases, the ratio of the inductance to the resistance must be 0·007, and the sensibility may be altered by putting non-inductive resistance in series with the secondary coil, as well as by altering the value of the inductances across which the instrument is shunted.

In the latest forms of hot-wire element the two hot wires C C_1 D_1 D and E E_1 F_1 F (fig. 3), fixed at their lower ends but electrically connected at E D, pass over an ivory pulley P, crossing diagonally at the top, but insulated from each other. Two horizontal wires (omitted in the diagram for the sake of clearness) connect C_1 to D_1 and F_1 to E_1. These wires cross each other without touching, and permit of a vertical movement of the upward wires but no horizontal movement; they also practically limit the current in the hot wires to the portion below them. The wire between F_1 and the pulley is tied by an insulating loop of thread to the wire between D_1 and the pulley, and the other two wires are similarly tied. An even tension is maintained on the wires by means of a spiral spring acting on the pulley. A mirror is fixed across the wires near the points where they are tied together, and when the wire E E_1 F_1 F is heated more than the other, the mirror is caused to rotate in the direction shown by the arrows.

The wires are immersed up to the level shown by the dotted line in oil contained in the brass casing of the hot-wire element, which is provided with an opening at the back through which it may be filled. A small fixed mirror is added for the purpose of giving a datum or zero line. Usually two elements are mounted together, on a metal levelling base. The natural frequency of the instrument depends somewhat on the size of the mirror and the sensibility required, but is usually about 6,000 per second, with a comparatively large mirror. The resistance of each wire circuit is

about 7 ohms, or for the two wires of the element in series, 14 ohms; when a polarising current of 0·5 ampere is passing through each wire a deflection of 8 centimetres between extreme positions, at a scale distance of 60 centimetres, is given by 0·1 R.M.S. ampere, flowing through the wires in series, with a sine wave of 50 cycles.

The damping of the oscillograph being small, it is necessary to damp the quantity of electricity flowing through it. This is

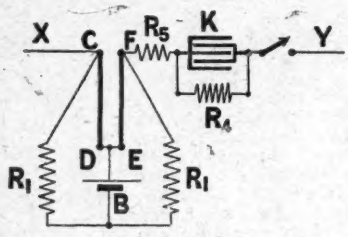


Fig 1.

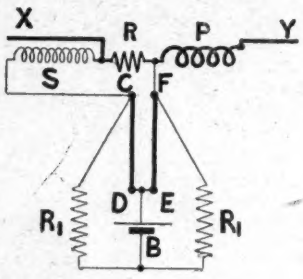


Fig. 2.

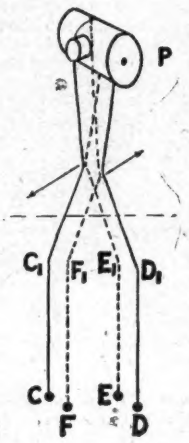


Fig. 3.

effected by a resistance R_5, fig. 1. This method of damping has the advantage of being more definite than that due to the immersion of a mirror in oil, and is fixed once for all for a given shunted condenser; moreover, the damping may be easily removed altogether, when it is required to exaggerate higher harmonics of small amplitude which otherwise would not be detected.

The two curves, fig. 5, are records of the current and pressure waves from an alternator, made with the Irwin oscillograph on a nearly non-inductive load, and show the ripples due to the teeth.

Owing to the high natural frequency of the hot-wire element, even when fitted with a comparatively large mirror, and to improvements effected in the optical arrangements, the same equipment

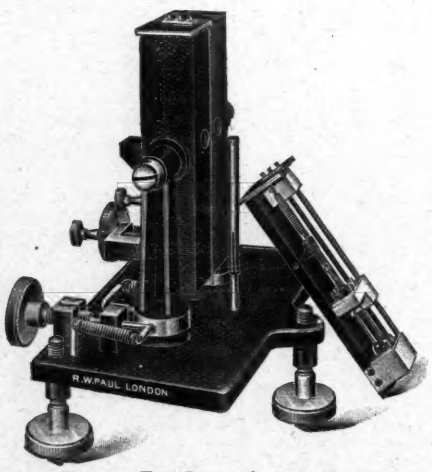


Fig. 4.—The Irwin Oscillograph.

may be utilised for projection as well as for observation, while for photographic recording simple accessories only need be added. The lantern is mounted on a baseboard to which the elements and the necessary optical equipment are fitted, and is provided with a condenser, in front of which is a vertical slit; the rays from this pass through a cylindrical lens before reaching the mirror, whence they are reflected back on to a vibrating prism. This prism reflects the beam from a horizontal into a vertical direction, and brings the spot to a focus on the horizontal tracing desk. For this purpose the prism has one face which acts as a reflector, and another which is cylindrically ground to a suitable radius.

The reflecting prism is vibrated by the action of a cam, attached to the shaft of a small synchronous motor, which can also be run on direct current.

Should it be required to take instantaneous photographic records, a special camera is arranged to fit in the space ordinarily occupied by the tracing desk, and continuous records may be obtained by means of a modified kinematograph camera, which may be substituted for the tracing desk.

The oscillograph may be considered to mark an advance from the point of view of simplicity and robustness, and will bear a considerable overload without injury; at the same time its high natural frequency adapts it to a large range of work, including speech-transmission records. The improvement effected in this last form, by which the oil-immersion of the mirror is done away with, renders the damping independent of temperature, and enables a clear spot to be obtained, while the electrical damping is definite and may be easily removed to demonstrate wave-forms in which higher harmonics or minute ripples in the curve occur.

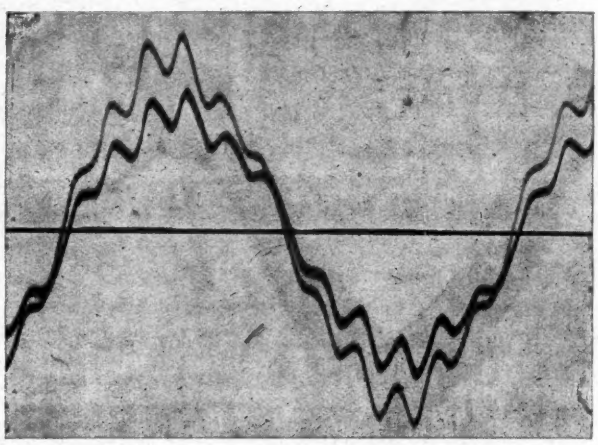


Fig. 5.—Irwin Oscillograms.

The Irwin oscillograph and its accessories are manufactured by Mr. Robert W. Paul, of New Southgate, and 33, Leicester Square, London.

THE PHYSICAL SOCIETY'S EXHIBITION.

The annual exhibition of physical apparatus, organised by the Physical Society, has now taken its place amongst the regular events of the winter season, and the excellent show provided indicates that it is appreciated by the manufacturers, while the keen interest manifested by the visitors shows that they also welcome the opportunity of studying the latest developments in such apparatus.

We recently gave a list of the exhibitors, and will now proceed to describe some of the exhibits; we may mention in passing that electrical and other measuring instruments bulked largely in the catalogue, and that the apparatus designed for teaching purposes, though well represented at some stands, was comparatively of minor importance and extent.

Mr. Robt. W. Paul.

The principal features of Mr. Paul's exhibit were the Irwin hot-wire oscillograph, Cohen's vibrating wire interrupter and barretter, and Campbell's constant-inductance resistance box; besides these new apparatus, Campbell's vibration galvanometer and variable standard of mutual inductance, Harris's deflectional resistance thermometer indicator, and various rheostats, &c., were shown. An account of the oscillograph is given above.

The vibrating wire interrupter, devised by Mr. Cohen, is a most interesting and convenient means of obtaining a small high-frequency current for use in connection with telephone research and similar investigations. It consists of a stretched wire carrying two contacts dipping into mercury, and a small armature, which vibrates in front of an electromagnet connected in series with one of the contacts. The other contact is connected with an oscillating circuit, giving rise to trains of damped waves of any desired frequency. By combining two such circuits in an extremely ingenious manner, Mr. Cohen has succeeded in producing a sustained alternating current of high frequency, and thus has arrived at a satisfactory substitute for the human voice for the purpose of testing telephone circuits and instruments. He has, in fact, brought sound production under measurable control, and has therefore effected a great advance in the application of scientific method to telephone research, to which his barretter had already contributed so much.

Mr. Albert Campbell's constant-inductance resistance box, intended for use in conjunction with his other instruments for the accurate measurement of small inductances and capacities, is so arranged as to enable the resistance to be varied without altering the inductance in circuit. The Harris thermometer indicator gives a direct reading of the temperature by deflection of the pointer, 90° of arc corresponding to a range of 200° C., and this range can be brought to any point on the C. scale up to 1,200° C. by moving a sliding switch.

Messrs. Pitkin & Co.

The principal item of this exhibit was the Roberts-Austen recording pyrometer, as used at the Woolwich Arsenal and other places; a description of this instrument was given in our abstract of a paper read before the Iron and Steel Institute by Mr. W. Lambert, in our issue of June 5th, 1908, but improvements have since been added which enable the temperature to be read externally at any moment, in connection with any particular circuit, without interference with the record. The Pitkin-White electrical pyrometers were also shown.

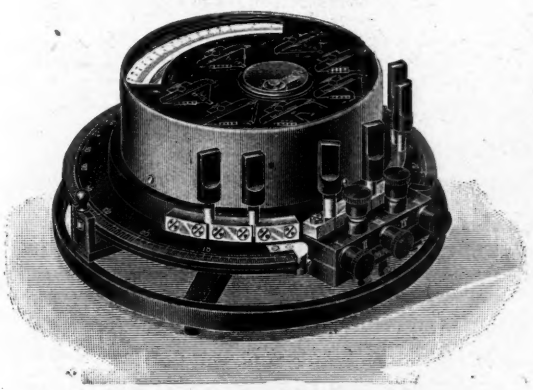
An anti-vibration stand for galvanometers, carried on spiral springs in compression, was exhibited; this has been successfully used even near heavy machinery. A variety of Holden-D'Arsonval and other galvanometers, testing sets, portable instruments, &c., was also shown.

Messrs. Newton & Co.

This firm showed a universal optical bench, available for a large range of experiments, and in connection with it Cheshire's projection polariscope, spectroscope and colour-mixing apparatus, with which very beautiful effects were produced upon the screen. Clay's wave ripple apparatus, in which waves are constantly maintained by means of a dipper attached to an electrically-driven tuning-fork, and Duddell's musical arcs arranged with a keyboard for demonstration purposes, were also exhibited, together with the Gregory sundial.

Messrs. Siemens Bros. & Co., Ltd.

A large variety of apparatus was shown by this firm, consisting mainly of electrical measuring instruments and kindred apparatus. Manganin shunts and series resistances, a combined voltmeter and ammeter for measuring current and pressure simultaneously over various ranges, a universal galvanometer, an ammeter and a wattmeter of the dynamometer type for A.C. and D.C., portable current transformer, double mirror-galvanometer, induction bridge, high-frequency machine, magnetising apparatus, and a portable



Siemens Universal Galvanometer.

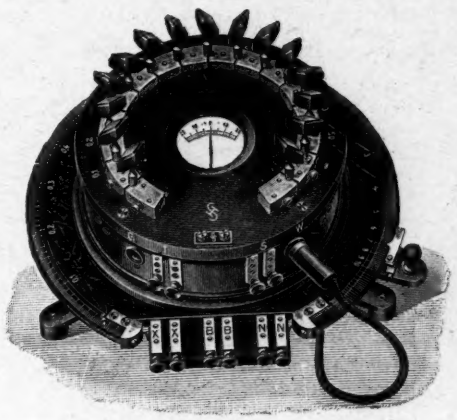
collapsible photometer were exhibited, with other items. The combined voltmeter and ammeter is fitted with a voltmeter and an ammeter movement having negligible temperature coefficient, mounted in a remarkably compact form on a common ebonite base, with terminals for four ranges each of volts and amperes. It is also provided with a device for attaching separate shunts; the shunts and series resistances are contained in the instrument case.

A moving-coil ammeter with 10-ohm milli-voltmeter has seven ranges self-contained, and can also be used with external shunts for ranges from ·15 to 7,500 amperes, or with series resistances as a voltmeter up to 750 volts. The "Feussner" combined shunt and switch for current ranges from 1·5 to 150 amperes is a convenient accessory, which permits of measuring current in seven ranges, and of passing from one range to any other without breaking the circuit. The universal galvanometer, which we illustrate, provides for the direct measurement of currents up to ·15 ampere, pressures up to 150 volts, E.M.F.s, battery and line resistances from ·03 up to about 30,000 ohms respectively, and for the localisation of faults. It consists of a moving-coil milli-volt and amperemeter of 1 ohm resistance, combined with a slide-wire Wheatstone bridge. The readings are not affected by external magnetic disturbances, and an excellent damping permits of rapid readings. The diagrams for the various uses of the instrument are engraved on the top.

The bridge wire is stretched round the edge of a slate disk in a half-round groove. A scale is engraved on the top edge of the disk, on which the position of the moving contact is read; the product of this reading and the particular multiplier in use gives the value of the unknown resistance. The movable contact itself consists of a small platinum roller carried on a movable arm, which is also fitted with an index moving over the scale. The contact resistance between the roller and the wire has no influence whatever on the accuracy of the measurement, as it is in the battery circuit. The resistances of comparison are made of insulated manganin wire. Five terminals, which are intended for connecting up the wires between the instrument, battery, unknown resistances, &c., are mounted on a projection of ebonite on the front of the instrument.

A connecting strip is supplied with the instrument, by means of which shunts may be attached as used with the milli-volt and amperemeters. Insulation resistances up to about 1 megohm can be measured with the aid of a 110-volt battery, and currents above ·15 ampere can be measured by means of shunts.

The dynamometer-principle wattmeter gives accurate readings with D.C. or A.C. of any frequency, wave form or phase displacement, independently of the length of time they are in circuit. The



Bridge for Large Coefficients of Inductance.

pointer is rendered practically dead-beat by means of a patent air-damping device. The instrument is made with two current ranges up to 400 amperes, either for pressures up to 30 volts or for three pressure ranges up to 750 volts. Series resistances are necessary for higher voltages, as well as for measurements on three-phase supplies having the three branches equally loaded.

In the case of unequal loading of the three branches, it is necessary to make two measurements, either with two wattmeters simultaneously, or successively with one wattmeter and a special change-over switch with short-circuiting device.

We illustrate below a portable current transformer for accurate laboratory purposes, in which the current range is altered by merely clamping a plug-connector in the primary terminal. These current transformers are made either for one range or with variable primary winding for several ranges, but with fixed secondary winding for 5 amperes. They are insulated for working pressures up to 12,000 volts, and in the case of currents above 500 amperes up to 6,000 volts. The ratio of transformation is constant between

Current Transformer with 3 Ranges, up to 5, 10 and 20 Amps.

10 per cent. and 100 per cent. of the rated load, and is independent of the wave form and of the frequency between 25 and 100 periods; for lower frequencies special calibration is necessary. As there is a comparatively high potential difference at the secondary terminals—namely, 4 volts—more than one instrument (*e.g.*, wattmeters and ammeters) can be connected to the transformer.

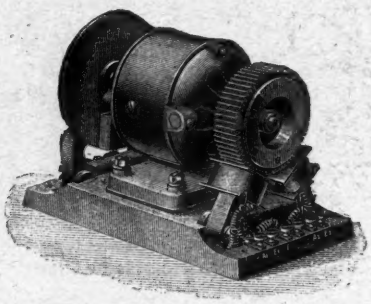
The Saladin double-mirror galvanometer is an apparatus designed for the purpose of reproducing a curve on a stationary photographic plate; it consists of two galvanometers, the mirrors of which are optically connected by means of a prism. The horizontal movement of the beam of light from the mirror of the first instrument is converted by the prism into a vertical movement, and the light is then thrown on to the mirror of the second instrument, where its vertical movement is combined with the horizontal movement of the mirror of the latter. The resultant of the horizontal and vertical movements gives the required curve. The apparatus can be worked for any speed of the ray of light up to 2·5 mm. per second, and with photographic plates of ordinary sensitiveness.

A vertical scale outfit for use with a mirror galvanometer was shown, which occupied very little space, both galvanometer and

scale being fixed close to the wall; the scale can be perfectly well read without darkening the room.

An uncommon type of apparatus was an induction bridge, for determining induction constants and energy losses in A.C. apparatus; the model shown was capable of measuring large coefficients of self-induction down to about 10^{-9} henry, and was provided with galvanoscope, bridge wire and plug resistances of ·1—50 ohms, for connecting to telephones, D.C. and A.C. circuits, and standards of induction. The bridge can also be used for the direct measurement of energy losses, for determining the coefficient of mutual induction and for the measurement of capacities and electrolytic resistances. Essentially this apparatus is a combined D.C. and A.C. bridge based on the Wheatstone principle. We give an illustration of it on p. 1043.

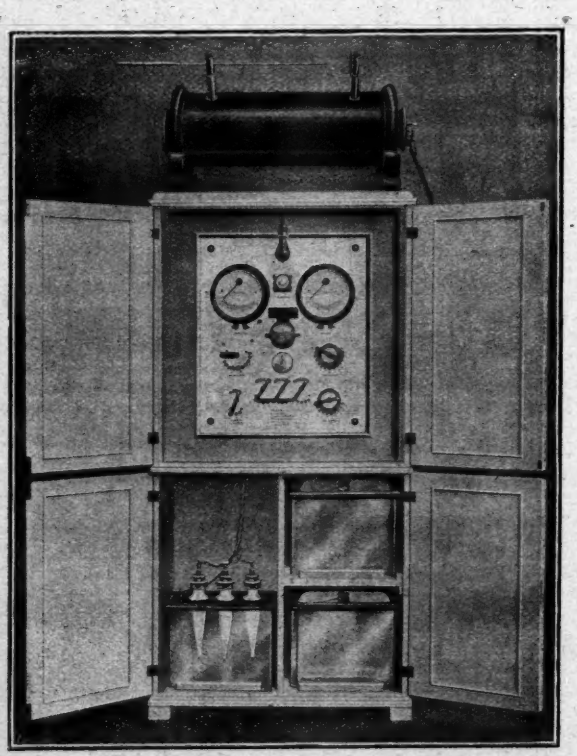
A small high-frequency machine was shown, for a normal frequency of about 1,000 cycles per second, with eddy-current brake, driving motor and starting switch for 110 or 220-volt circuit, with contacts for connecting up a frequency meter. The machine consists



Siemens High-Frequency Machine.

essentially of a small inductor alternator, pulsations of electromotive force being produced by variations in the magnetic flux as the teeth of the serrated soft-iron inductor pass the faces of the pole-pieces.

The magnetising apparatus exhibited consists of a magnetometer, a base-board with connections, a single-switch resistance, a triple-switch resistance, and a test bundle of sheet-iron, with magnetising curve and air line. Practically speaking, the magnetometer is



Siemens A.C. X-Ray Outfit in Cabinet.

based on a reversal of the principle of Depres d'Arsonval, the moving coil in the present instance being supplied with constant current, whereas the magnetic circuit, which consists of the iron under test, is energised by variable ampere-turns.

The magnetometer gives the value of the magnetic induction direct in C.G.S. lines per square centimetre by the deflection of the pointer, and the hysteresis loop can be plotted by a series of readings. The accurate determination of the absolute values necessitates but simple corrections. The materials to be tested are in the form of bars or bundles of strips.

The Electric Appliances department showed a complete outfit for rectifying alternating current for X-ray work, suitable for use on pressures from 100 to 600 volts. The accompanying illustration shows the apparatus mounted in a cabinet for hospital use; it is also made in separate parts for consulting work. A 20-in. spark induction coil was mounted on the top of the cabinet, while inside the latter there was a switchboard, triple Wehnelt interrupter, and a set of electrolytic valves. The switchboard provides for all possible requirements; the length of spark can be regulated in six steps, and its intensity in three, a special choking coil forming an extension of the primary being employed for the former purpose, and graduated Wehnelt interrupters for the latter; the frequency of the sparks can be controlled by means of two rheostats; the main current and primary current can be measured; the condition of the electrolytic valve apparatus can be tested with facility by means of a patent switch; the output of the coil can be adapted to suit all kinds of X-ray tubes, hard or soft, and there are no rotating parts in the apparatus. The apparatus, moreover, can be used for charging accumulators, running mercury-vapour lamps of the Uviol or quarts types, arc lamps, and electromagnets, and is available for use on D.C. as well as on A.C. supply circuits, so that it is practically of universal application. In the separate outfits the switchgear, &c., is mounted on a pedestal table.

Messrs. Everett, Edgcumbe & Co., Ltd.

A portable self-contained potentiometer formed an interesting feature of this exhibit. This instrument, which is illustrated herewith, has been specially designed for such work as checking ammeters, voltmeters and wattmeters on site, and also for photometer work. The particular pattern shown was designed specially

Everett, Edgcumbe Portable Potentiometer.

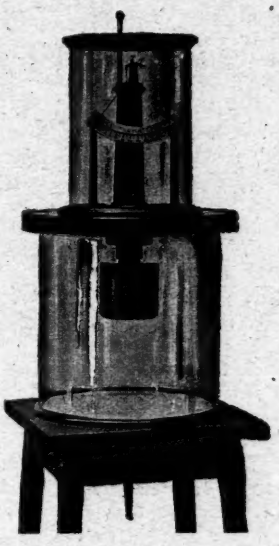
for the latter work, and had three current ranges, for maxima of ·3, 1·5 and 6 amperes, and volt ranges of 75, 150 and 300 volts. The galvanometer, which is provided in the case, is amply sensitive enough for all ordinary commercial work. If, in any special case, additional sensibility is required, provision is made whereby an external reflecting galvanometer can be employed at will.

Portable Astatic Wattmeter.

The slide wire, which is circular, gives a scale approximately 12 in. long, and in series with this are 14 similar coils, so that the effective scale length is about 15 ft.

The Clark or cadmium cell is contained in the case, but is readily removable. Various shunts can be supplied, thus extending the range of the instrument to any required degree. Besides measurements of current, pressure and power, the instrument is particularly suitable for the measurement of low resistances, and, in fact, for all direct-current electrical measurements where considerable accuracy is desired.

Another interesting item was a portable multi-range astatic wattmeter suitable for single, two, or three-phase loads, and provided with four pressure and four current ranges. It is constructed on the dynamometer principle, and being astatic, is quite unaffected by stray magnetic fields. The change-over from one volt range to another, or from one form of connection (for example, two-phase), to another (for example, three-phase), is done entirely by means of a simple change-over switch fixed to the side of the

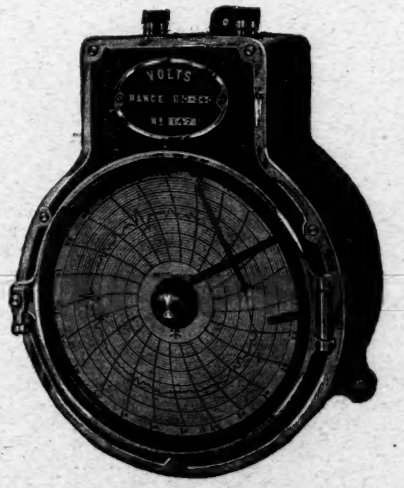


JONA EXTRA-HIGH-PRESSURE VOLTMETER.

case. The current ranges are obtained by means of a multi-range transformer fitted in a portable wooden case, and designed specially to give a negligible phase and ratio error.

The wattmeter itself has a non-inductive pressure circuit free from capacity effects, so that the instrument can be used with perfect safety, even down to very low power factors.

Messrs. Everett, Edgcumbe & Co. also showed a low-pressure electrostatic voltmeter on Hamilton's patent, and the Jona extra-high-pressure electrostatic voltmeter, which we illustrate; the latter reads up to 60,000 volts, and naturally its construction is very different from that of ordinary types. The working parts are



EVERETT, EDGCUMBE RECORDING VOLTMETER.

entirely enclosed in glass cylinders, and work on the attracted-disk electrometer system, the moving disk being suspended from the indicating mechanism within the metal screen seen in the lower cylinder, while the fixed disk is at the bottom of the latter, which is filled with oil for the sake of deadbeatness and dielectric strength. Voltmeters for intermediate ranges are also made.

Besides the firm's various types of ammeter and voltmeter, phase-meter, frequency indicator, and inkless recorders, a disk pattern of recorder was exhibited in which the chart takes the form of a flat disk rotating once a day, or once a week, the entire record being always visible. As will be gathered from the illustration, these recorders are very compact and suitable for use on switchboards. The Trotter Universal portable photometer was also shown.

(To be continued.)

REVIEWS.

Handbook of Electrical Testing. By H. R. KEMPE, London: Spon & Co. Price 18s. net.

It is with a certain sense of difficulty—we had almost said diffidence—that we approach the review of this work, which many years ago established, and has ever since maintained, its position as a standard text-book on one of the most important of the theoretical and practical applications of the science of electricity and magnetism. We are inclined to wonder how many, or rather, how few of our most learned investigators are there who have not had recourse to its many pages of valuable information regarding the theoretical principles of the many testing operations which they find necessary to employ in their daily research operations. The book, too, must have been, during the years that it has been before the public, a veritable mine of information to those who have produced the multitudinous array of note books, *aides-memoire*, &c., compiled for the assistance of electrical engineers throughout the world. By this we do not desire to imply that the book has lent itself to anything in the nature of plagiarism, but merely that from its encyclopædic character it must naturally have been a particularly useful index to enable such compilers to differentiate between the many worthy and worthless methods of testing with which most of the profession are more or less acquainted.

We now are called upon to review the seventh edition, the necessity for which seems to demonstrate very clearly that the previous editions have fully justified their production. In this edition, however, we notice the signs of probably more exhaustive revision than was observable in any of its predecessors, together with a fuller recognition of the advances which have taken place in the science since the advent of the previous edition (to the latter point we shall revert further on). On the whole it is apparent that the book has been thoroughly revised and brought up to date.

As examples of the thoroughness of the revision we may mention that the chapter dealing with localisation tests appears to have been completely rewritten by the author, who has availed himself of the opportunity afforded thereby to bring it into concord with the practice of the present day. Also the formulæ for Rymer-Jones and Kennelly's tests have been so revised as to enable direct comparison between them to be made; this in their previous form was a matter of some little difficulty. We observe also that the information regarding the practical application of corrections for temperature (page 515) has been rewritten completely.

Of new matter we find about 50 pages added to and dispersed throughout the book, embodying, amongst other up-to-date details, descriptions of the cadmium standard cell, the Broca galvanometer, methods for the measurement of the resistance of electrolytes, a new Wheatstone bridge test which enables the conductor resistance of a circuit to be measured when an extraneous earth or leakage current is flowing therein, a full and very detailed description of that most modern of instruments, the Megger, and a most interesting and useful description of the Raymond-Barker calculating board. The reference to Price's guard wire also, we think, is new.

We notice, however, that the author has considered it necessary to retain in the book the description of and formulæ for the battery test which was devised by the Post Office authorities for use at their telegraph stations some years ago. This, we think, might surely have been eliminated from the edition before us, for we believe that at all stations where primary batteries had been in use in such numbers as to call for special testing methods, secondary batteries have been, or are being, introduced, and such special tests are therefore being replaced by more simple voltmeter tests. The system possesses, doubtless, a certain amount of academic interest, but such hardly justifies its retention in an edition that aims at being completely up to date.

As an essentially English journal we feel that, in spite of the obvious merits of this edition which we have attempted in some measure to delineate, we have a prescriptive right to express the similarly essentially English grumble, although the author somewhat disarms criticism by saying in the

preface that he does not consider it advisable to alter the general scheme of the book. That which appears to us to be a just cause for complaint is that even in the seventh edition—which we hope is not bound up with, or even influenced by, the mythic mysticism implying finality and perfection usually attached to that particular number, so as to preclude any possibility of an eighth reprint in which our present suggestion may be embodied—there is so little which is applicable to the testing operations which are vitally necessary to such engineers as those who deal particularly with the questions involved both in the theory and practice of electric light and power distribution. Nor is there much dealing with the problems arising out of the most recent developments in telephony. It is true that many of the testing formulæ and instruments described, are useful and even essential to the specialists to whom we refer, but nevertheless, recent progress in these branches of the profession has called for many new methods and a number of new instruments which are well worthy of, and should certainly find a place in, a "Handbook of Electrical Testing." At present the book seems dedicated in spirit more to laboratory and submarine cable practice, with its adjuncts; and the latter, of course, in the early days of the appearance of the book, was the principal feature of electrical engineering. But now the general scope of matters has so much enlarged and widened that, as in the case of the old Society of Telegraph Engineers, wherein it was found necessary to make a change with the growth of the profession, we think this book might with advantage also be changed and increased in scope, and, as the present work is a bulky tome, we should like to see a future edition split up into a suitable number of distinct volumes, each dealing with its own particular branch of the applied science, and each capable of revision as the progression in its own special line renders necessary. Then we may hope to see this work going down to posterity as a means of constant reference—instead of ultimately becoming, as we fear, a classic (and thereby suffering the usual fate of classics)—and occupying, as it richly deserves, a place in the library of every electrical engineer, be he consultant, power, tramway, telegraph or telephone engineer or even student.—R. M. H.

Switchboard Measuring Instruments for Continuous and Polyphase Systems. By John C. Connan. London: E. & F. N. Spon. 5s. net.

The object of the work under review is to supply a long-felt want in the shape of a short volume dealing with the design and construction of electrical measuring instruments. The contents have been collected from numerous reviews, magazines and papers read before various learned societies, of which a list is given in an appendix. In the descriptions of the various instruments, only as much of the details of construction as have been thought necessary to a correct understanding of the subject have been given, and consequently the volume is unencumbered with a confusing amount of miscellaneous work that could easily have been inserted.

Chapter I is introductory, and gives concise practical definitions of such things as current, voltage, power, phase difference, lag and lead, wave form, frequency, &c. The principles upon which instruments are built—the (1) magneto-dynamic, (2) electro-dynamic, (3) electro-magnetic, (4) electro-thermic, (5) electrostatic, (6) resonance—are then enumerated, and are tabulated so as to be readily referred to in what follows.

Chapter II is devoted to generalities, and deals with recording devices (incidentally the "synchronome" clock is mentioned, which uses a hard steel style giving a succession of light blows instead of ink), scale markings, cases, methods of connection to switchboard pointers, controlling force, damping devices, shunts, external resistances, transformers and properties of material used in construction. The fact is mentioned that after a series of experiments, Madame Curie arrived at the conclusion that for the best steel magnets, tungsten steels, properly hardened by quenching, should be used.

Chapter III deals with the magneto-dynamic principle, and the construction of ammeters, voltmeters, and leakage indicators under this head is given concisely and clearly. A feature is a couple of pages on the theory involved, so nicely arranged as to be understood by a very mediocre mathematician.

The electro-dynamic principle is then taken up, and various types of instruments are considered in order. An important point is, that after each description of instrument and its construction, a note is appended giving the sources of error likely to detract from its value, and methods of eliminating or, at least, diminishing these effects are suggested.

Chapter V deals with induction instruments operating on the electro-dynamic principle, and amongst others a frequency meter is described.

Chapter VI has to do with instruments of the rotating field class, and Chapter VII with instruments working on the electro-magnetic principle on the moving iron system.

The hot-wire system is then considered. The chief advantage of these hot-wire instruments lies in the fact that the readings are entirely free from errors arising from frequency, wave form, and stray magnetic fields, while the error due to self-induction is so small as to be negligible.

Chapter IX deals with electrostatic instruments on the moving vane system. The author very truly remarks that for switchboard work, there is not a great deal to recommend this type, as, on high pressures, where it would most likely be employed, it is now possible to employ the magneto-dynamic principle for continuous-current circuits or the electro-dynamic or electro-magnetic principles for alternating circuits in conjunction with potential transformers.

Chapter X, the last, gives a short description of the interesting resonance principle. The resonance instrument can easily be made to read to 0·2 per cent. of accuracy.

This book contains 145 pages. The printing and get-up are excellent, and the diagrams and photos all that could be desired. It truly fills a decided gap, and not only fills it, but fills it well. One has pleasure in reading it, with its well-balanced theory and practice.

BUSINESS NOTES.

Catalogues and Calendars. — The Consolidated Accessories Co., 27, Clement's Lane, E.C.—Illustrated leaflet containing various diagrams, and a description of the "Peacock" brake rigging.

Messrs. W. Geipel & Co., Vulcan Works, St. Thomas's Street, London, S.E.—16-page fully illustrated catalogue dealing with the Ward Leonard rheostats. A separate leaflet gives special prices for surplus stock. Great reductions have been made in the prices of motor controllers and starters.

The Victoria Dynamo and Motor Co., Craven House, Kingsway, W.C.—Folding advance card giving sizes and prices of "Victoria" A.C. motors, ranging from ·5 to 85 B.H.P., for 50 periods two or three-phase; prices of starters are also given.

Messrs. E. Brook, Ltd., Colne Road, Huddersfield.—Section 16 price sheet of single-phase motors (50 cycles) ranging from ¼ to 30 B.H.P. Also a calendar with monthly date slips above which appears a very effective picture of one of the firm's electric motors.

Messrs. Alfred Herbert, Ltd., Coventry.—From this firm we have never received a price list or catalogue that has not been executed in high class and altogether faultless style. The calendar just received for 1909 is a bold plainly printed one got up in a style which does the firm credit and will guarantee it a place on the walls of the most palatial offices of the unemployed consulting engineer, as well as on our own humble colour-washed ones. On each monthly sheet above the dates is a finely-executed half-tone illustration of one of the firm's manufactures.

Messrs. Isenthal & Co., 85, Mortimer Street, London, E.C.—48-page catalogue (list No. 16) of Ruhstrat rheostats for all purposes, switchboards, bridges, &c. It is a well arranged list with prices, weights, and other particulars conveniently set out, and with many interesting diagrams and exterior illustrations.

The Foster Arc Lamp and Engineering Co. have issued a hanging show-card drawing attention to the Foster transformers for metal-filament lamps.

Messrs. E. Bennis & Co., Ltd., Little Hulton.—Sixteen-page illustrated publication relating to the economy of small elevators worked in conjunction with automatic stokers in textile mills, flour mills, printing works, &c. Copies of the pamphlet can be obtained on application.

Messrs. Ludw. Loewe & Co., Ltd., Farringdon Road, Clerkenwell, E.C.—Desk calendar with perforated daily slips. The arrangement is such that by tearing off the slip for each day as it passes, a week's engagements are exposed to view. On the back of the card on which the slips are mounted, are calendars for the years 1908, 1909 and 1910.

Messrs. Siemens Bros. & Co., Ltd., and Messrs. Siemens Bros. Dynamo Works Co., Ltd., have again, as in previous years, favoured us with one of their Letts's pocket diaries for the new year. Its opening pages contain useful and instructive matter relating to the Siemens manufactures, and roomy daily note spaces follow, while in an end pocket there is a general memoranda inset whereon to keep a note of your own (or the other fellows!) debts.

Messrs. Thomas Bolton & Sons, Ltd., 88, Bishopsgate Street Within, E.C., have favoured us with one of their choicely bound Letts's pocket diaries and note-books for 1909, with insurance coupon and a number of Messrs. Bolton's wire, cable and tube tables.

Private Meeting.—Cort, Paul & Cornick, Leicester, electrical engineers, manufacturers, &c.—The creditors of the above were called together last week at the Grand Hotel, Birmingham. A statement of affairs was then presented, showing liabilities amounting to £21,757, of which £9,961 was due to trade creditors. Mr. Paul was scheduled as a cash creditor for £9,209, and Miss Cornick was also returned as a cash creditor for £973. The bank were set down as partly secured creditors, their claim amounting to £2,391. They held securities valued at £777, thus leaving £1,614 to rank as unsecured. There was a contingent liability on bills discounted of £121, none of which were expected to rank against the estate. After allowing £745 for preference claims, the assets were estimated to realise £20,253, a deficiency being thus disclosed of £1,504. The assets were as follows: Stock-in-trade, plant, tools, fixtures, fittings, &c., as per valuation, £14,300; book debts, £7,139, estimated at £6,087; cash in hand and bills, £302; and estimated work in progress, £309. A solicitor who appeared for the debtor stated that he had only recently been consulted in the matter. As soon as he heard that proceedings had been started by several creditors, and that the landlord had put in a distress for three quarters' rent, amounting to £600, he immediately decided that a deed of assignment should be executed to Mr. West, of Leicester, in order to protect the assets. The accountant then explained the statement in detail and the position of the business since it had been obtained by Mr. Cornick. It appeared that Mr. Cornick purchased the business in 1896 from Mr. Paul, on a valuation, the amount being £22,199. At that time Mr. Cornick had a capital of about £8,000, and he paid a sum of £7,440 off the purchase price. It was arranged that the balance should be paid by instalments of £800 per annum for a few years, and then by yearly payments of £1,000. The instalments were regularly paid up to 1901, when Mr. Cornick was able to reduce the amount still owing by means of loans from his sister and other sources. The landlord of the premises was Mr. Paul. In 1900, under a clause in the agreement, further premises were built at the back of the existing ones, and the rent was increased by £300 a year. A sum of about £1,000 was also spent in fixtures. In 1902 efforts were made to get a partner, but these efforts were unsuccessful. Owing to depression, the sales fell off considerably in 1905, and the expenses were then reduced. The works in Thornton Lane, Leicester, were closed, and the plant, &c., removed to Syston. Premises were here taken, and adapted to suit the requirements of the electrical manufacturing business, which had previously been carried on at Thornton Lane. The accountant gave it as his opinion that the business was too big for one man to manage, especially when there was a shortness of capital. During the first few years, the concern showed a profit, but since then business had not been so successful. For the 18 months ended June last, there had been a loss on the business of about £2,700. The drawings had been between £500 and £600 a year. It was said that Mr. Cornick had no offer to make. Many of the creditors expressed the opinion that it would be a pity to close the concern, and that efforts should be made to continue it. It was also suggested that Mr. Paul might be able to make some concessions. The matter was discussed at great length, and eventually the deed of assignment was confirmed, Mr. G. G. Poppleton (Messrs. Poppleton and Appleby) being appointed to act as joint trustee. A Committee was appointed, consisting of the representatives of the principal creditors, to confer with Mr. Cornick and others interested to see what could be done in the matter.

The Austrian Import Duties.—It is reported that the Bergmann Electricity Co., of Berlin, is negotiating with a view to the erection of a branch establishment at Bodenbash, Austria. The object is to avoid the high import duties which were introduced under the new tariff of three or four years ago. Various other German firms started works in Austria a number of years ago before there was any prospect of an advance in the tariff rates.

Ball Bearings.—An interesting application of ball bearings is being undertaken by the Marseilles Tramway Co., who are now fitting 20 of their tramcar motors with ball bearings. The chief engineer of the company has been induced to take this progressive step by the remarkable success which has attended the preliminary trials on a car motor thus provided. The motor in question was one developing 35 H.P. at 1,000 B.P.M. with the shaft running on D.V.F. ball bearings made by Messrs. Ludw. Loewe and Co., Ltd. The car has been in constant service since the summer of 1904, and during the four years it has covered some 64,000 miles without any trouble whatever arising from the bearings. Considerable interest in the experiment was evinced by the Paris Tramways Co., and in November, 1907, they, too, started running a car provided with a similar ball-bearing motor on the Malakoff-Les Halles service. So far this innovation has given complete satisfaction. Experience showed that ball bearings were more durable than the plain, and, consequently, did not require the frequent renewals necessary with the latter variety. This is strong evidence that good ball bearings are perfectly reliable, provided they be of suitable size and correctly mounted.

Christmas Holidays.—The Union Electric Co., Ltd., of Park Street, Southwark, announce that their offices, works and stores will be closed from December 25th to 29th.

Bankruptcy Proceedings.—S. F. H. Taylor.—At the London Bankruptcy Court last Tuesday, S. F. H. Taylor, formerly carrying on business in partnership with H. R. Killick, at Bridge House, 181, Queen Victoria Street, E.C., applied to Mr. Registrar Linklater for an order of discharge. According to the report of Mr. E. S. Grey, Official Receiver, the firm failed in May, 1899, and a dividend of 5d. in the £ had been paid on provable debts amounting to £2,362. In October, 1897, the applicant patented an invention for electrically illuminated advertisements known as the Reflex Advertising Medium, of which it was agreed that his partner, Killick, was to have a one-half share, whilst he (Taylor) was to devote the greater part of his time to developing and selling the patent. Beginning without capital with which to develop the patent, the bankrupt sold one-half share of it for £500, and borrowed from time to time about £1,200 on their joint promissory notes; they were unable to sell the patent, and in March, 1899, their stock and effects were sold under an execution, and realised insufficient to meet the landlord's claim for rent. The failure of the firm was attributed, among other causes, to their inability to dispose of the patent, and to liabilities in connection therewith, but in the opinion of the Official Receiver it was also caused by the excessive drawings of both bankrupts. After hearing Mr. Arnell in support of the application, his Honour granted an order of discharge, subject to a further suspension of two years. Order entered accordingly.

Ernest Goacher, electrical engineer and ironmonger, Gateford Road, Worksop.—A first and final dividend, 2s. 4½d. in the £, is payable December 15th, at the offices of the Official Receiver, Figtree Lane, Sheffield.

Book Notices.—"Artificial and Natural Flight." By Sir Hiram S. Maxim. London: Whittaker & Co. 1908. Price 5s. net.

"Papers and Reports Relating to Minerals and Mining; New Zealand." Wellington: J. Mackay. 1908.

"Submarine Cable Laying and Repairing." By H. D. Wilkinson. London: The *Electrician* Printing and Publishing Co., Ltd. 1908. Price 15s. net.

"The Theory of Electrical Measurements." By W. A. Anthony. Third edition. New York: J. Wiley & Sons (London: Chapman and Hall). 1908. Price 4s. 6d. net.

"Hazell's Annual, 1909." London: Hazell, Watson & Viney, Ltd. 1909. Price 3s. 6d. net.

The "Rapidity" Steam Trap.—We recently were present at a demonstration of the working of this trap at the works of the makers, Messrs. Geipel & Co., St. Thomas' Street, S.E. A description of the trap was given in our issue of May 1st last; we may, however, point out again that the new trap constitutes a great improvement on the original Geipel steam trap, which had attained a world-wide fame. The valve has been rearranged so that it is held on its seat by the steam pressure, and therefore can be of much larger area than formerly; it is of the rotating type, and is lifted well off its seat when blowing through. It is most readily accessible for inspection, and will work without readjustment over a very wide range of pressures; the loss by radiation is even smaller than in the original Geipel trap. At the demonstration the quickness and completeness with which the discharge took place, and the total shut-off as soon as it was finished, were shown to be remarkable, and the action of the trap was extremely efficient and satisfactory. We should imagine that the new type will enjoy even greater popularity than its predecessor.

Plant for Sale.—The Newcastle-upon-Tyne Electric Supply Co., Ltd., is offering for sale certain electric power plant which is referred to in an advertisement in this issue.

Dissolutions and Liquidations.—Aluminium Corporation, Ltd.—A petition presented by Brownlie and Murray, Possil Ironworks, Denmark Street, Possil Park, Glasgow, creditors, for the winding up of this company, is to be heard in London on January 12th, 1909.

Cutler, Wardle & Co., Ltd.—A meeting of creditors is to be held at 60, Spring Gardens, Manchester, on Monday, December 21st. Liquidator, Mr. A. G. Mellors.

The Private Telephone Co., Ltd. (Old company).—A meeting is to be held on January 20th at 27, Chancery Lane, W.C., to hear an account of the winding up from Mr. S. Hollingum, liquidator.

Trade Announcements.—Bruce Peebles & Co., Ltd.—We are asked to state that this company has been successfully reconstructed, and is actively engaged in the manufacture of all the different classes of electrical machinery with which its name has for so long been associated. "The business has been conducted without interruption, and as its control is now in the hands of an entirely new and influential board of directors, it is believed that the success of the business is assured." The new board consists of the following gentlemen: Messrs. A. W. Tait, M. B. Mountain, C. J. Shiells, Alex. Mackenzie, Chas. H. M'Ewen, F. E. Andrews. The company owns the sole manufacturing rights, in Great Britain and the Colonies, of the well-known "motor-converter."

Mr. A. J. Andrews, agent for the Cantie Switch Manufacturing Co., of Nottingham, has changed his address from Mark Lane to 86, Leadenhall Street, London, E.C.

Messrs. Schoen Bros., who are agents for E. Holtzmann & Co., Weisenbachfabrik, im Murgthal, Baden, manufacturers of telegraph Morse and record paper, have introduced these manufactures to several leading telegraph companies.

Mr. G. H. Findlay has taken over the electrical engineering business carried on at 18, Holywell Hill, St. Albans, by Mrs. E. R. Howells and her late husband.

LIGHTING and POWER NOTES.

Amersham.—The Chesham R.D.C. has received notice that the Chesham E.L. Co. is applying for a prov. order for E.L. in the Council's district.

Audenshaw.—The U.D.C. has declined to entertain the offer of Manchester T.C. to light the streets by electricity at £2 5s. per 64-c.p. lamp per annum. The Council has also requested the Corporation to proceed with the completion of the electricity scheme forthwith.

Bath.—The B. of T. is to be asked to receive a deputation in regard to the matter of the sale of the electricity undertaking to Mr. Schenk and the proposed application for Parliamentary powers by him.

Bradford.—The Electricity Committee of the T.C. has recommended an extension of plant at the Valley Road Works, at a cost of £50,300.

Brighouse.—The T.C. has received from the L.G.B. sanction to a loan of £3,940 for the erection of a transformer station, &c., in connection with its bulk supply project.

Burslem.—The L.G.B. has forwarded to the T.C. sanction to loans of £10,094 for electric light purposes.

Canada.—The Canadian Pacific and Grand Trunk Railways are experimenting with cars electrically lighted on the Stone system. These cars have already covered 130,000 miles with satisfactory results, and it is expected that electric lighting will be gradually extended to the majority of Canadian stock.

Cheltenham.—On an appeal the assessment of the electricity undertaking of the T.C. has been reduced from £4,850 to £3,200. The former assessment was £1,800.

Chippenham.—Owing to the cost entailed in obtaining a further order enabling the T.C. to transfer the E.L. order to a private company, the Council has decided to approve of the proposed company starting as a non-statutory company, and to consent to underground mains being laid. The Council also undertakes to support at any subsequent time an application by the company for statutory powers.

Continental Note.—Italy.—The Municipal authorities of Rome have applied for a concession to put down a plant to utilise the water power of the River Tevere in the generation of electrical energy for power purposes.

Cork.—We are informed that the motion to advertise for tenders for lighting the workhouse was carried, and not *lost*, as mentioned in last week's issue.

Darlington.—The Electricity Committee is to consider a request for electricity supply to a large number of workmen's houses, in which penny-in-the-slot meters are proposed to be used.

Dublin.—The Electric Lighting Committee of the Corporation reports that the estimated expenditure for the year to March 1st, 1909, is £58,491; estimated income, year to March 31st, 1909, £61,391. Total payments, six months, to September 10th, 1908, £29,921; total receipts, six months, to September 30th, 1908, £24,785. The public lighting account shows that the estimated expenditure for the year to March 1st, 1909, is £26,815, and that the total payments for the six months ended September 30th, 1908, amounted to £11,801.

At the meeting of the Corporation last week, a motion to increase the amount applied for in connection with the electric lighting extensions by the sum of £1,320, to cover the extra expenditure on the arc lighting of the North Circular Road and the Drumcondra Road, was passed.

Frome.—The U.D.C. has received from the L.G.B. sanction to a loan of £9,605 for E.L. purposes. A sum of £1,696 10s. 2d. had been deducted from the sum applied for in respect of overcharges made for house services, meters, costs of prov. orders, &c.

Glasgow.—The T.C. has received from the Secretary for Scotland an intimation that that official had now formally given his consent, in terms of the Electric Lighting Acts, to the borrowing by the Corporation of a further sum of £150,000 for the execution of capital works, under the Glasgow E.L. Order, 1890, and the Burgh of Pollokshaws E.S. Order, 1905, raising the total sum authorised to be borrowed for that purpose to £2,000,000.

Golborne.—The B. of T. has asked the U.D.C. if it has any representations to make before the Board proceeds to determine whether the E.L. order, 1905, shall be revoked or not, no steps having been taken to carry out the order. The Council has referred the matter to a committee.

Govan.—A Sub-Committee has been appointed to inquire into and report upon the extension of the present electrical installation system. Two alternative schemes have been drawn up by the burgh electrical engineer, one involving an expenditure of £14,000, and the other £11,000.

Gravesend.—The T.C. has authorised the electrical engineer to arrange a scheme for free and assisted wiring of houses, the work to be done by local contractors under the supervision of the Corporation, who, while collecting the rentals, will undertake no financial responsibility.

Hemel Hempstead.—The T.C. has decided to confer with the Chesham Electric Power Co. with reference to the company's application to the B. of T. for a prov. order for E.L. The members of the T.C. favour the introduction of the electric light owing to the high cost of gas.

Jamaica.—Mr. J. Hutchinson, President of the West India Electric Co., in an interview with a representative of the *Montreal Star*, gave an opinion on trade, &c., in Jamaica. The *Jamaica Guardian*, in a review, states that it is difficult to refrain from thinking that as President of the Electric Co., his policy is to escape contract obligations and to give the public of Kingston and St. Andrew a poor lighting and tramway service, whilst securing full payments. Our contemporary suggests an attempt to reduce tramway facilities in order to compel payment of a double instead of a single fare, and the decision not to install more light and power machinery at the power house has produced disappointment locally. While anxious that the company should be successful, the *Guardian* maintains that this can only be done by making the service satisfactory.

London.—Westminster.—In a report to the Council, the Highways Committee recommends that Mr. Ernest L. Walford be allowed to experiment on a portion of the Council's property near the Grosvenor Canal with Sir Oliver Lodge's system of dissipating fog by means of electricity.

Luton.—The T.C. has agreed to the erection of a cooling tower with a capacity of 100,000 gallons per hour, together with the necessary pipe-work, &c., the cost being £753.

Maldens and Coombe.—In connection with its electric lighting order, the U.D.C. (having received a letter from the County of London Electric Supply Co., stating that the company could fix no date for starting work at Malden), has decided to place all the correspondence in the hands of the B. of T. and call the attention of this authority to the condition of affairs in regard to the matter.

Radcliffe.—On the 10th inst., the L.G.B. inquiry into the application of the U.D.C for sanction to borrow £14,350 for the extension of the electricity works was resumed. Mr. Pickstone, Sir Robt. Hampson, Mr. C. D. Taite, Mr. Horace Parshall and others gave evidence to show that the commission on power supply demanded by the Council had been a barrier to the company's progress. Mr. Taite contended that the supply given by the Council to the Bury tramways was the only one likely to keep the Council's undertaking going; if the price were reduced to the level of other power consumers in Radcliffe there would be a loss on the supply. It was also urged that possible power consumers should be allowed to treat freely with the company. The chairman of the Radcliffe Electricity Committee suggested that in any case his Council could obtain a bulk supply on better terms from the Bury Corporation than from the company. The inquiry was closed.

Ramsbottom.—The U.D.C. has granted permission for the Lancashire Electric Power Co. to supply energy to the Chatterton Weaving Co.'s new mill, subject to the Council being paid 2½ per cent. on the receipts.

Reading.—At the last meeting of the T.C. a return was presented showing that the tramway receipts between the commencement of the current financial year and November 5th amounted to £20,118, against the receipts of the corresponding period last year of £19,853. The balances in the treasurer's hands were given as—Capital account, £6,235; revenue account, £2,265.

South Africa.—The annual report of the borough electrical engineer of Durban states that the net profit for the year ended July 31st, 1908, amounts to £14,849, which is a highly satisfactory result. Private consumers have increased by 251, the total number of consumers for light being 3,931, and for power, 244; total units sold amount to 6,025,860, including tramway current. The total number of street lamps are 275 arcs, and 1,575 incandescents, and the latter are being largely added to on account of a decision to replace all oil lamps by incandescents; the length of cables laid amounts to 117 miles, and for overhead trains 103 miles. The works cost per unit sold equals 1·26d., while the total cost, including capital charges, is 2·3d.; further economies are hoped for in the coming year, as it is hoped to have a Parsons steam turbine at work soon, driving a combined D.C. and A.C. set, during the greater part of the 24 hours. An exhaust steam turbine is also hinted at as a means of still further economising.

A fatal tramway accident occurred at Port Elizabeth on November 17th, whereby a motorman (Graham) met his death, while the conductor and three passengers had very narrow escapes. For some reason yet to be learned, the car suddenly gained in speed, and before anything could be done, it had reached a bend in the track, where it completely overturned, with the result as stated.

Litigation is threatened at Bulawayo between the T.C. and the electric lighting company which holds the concession for public lighting. The Council contends that the company has failed to light the town, and that it refuses to do so.

Wednesbury.—The Corporation has come to terms with a company against which it was proposed to take action in regard to certain plant supplied. According to the *Birmingham Daily Post*, "the contract, which was entered into with a foreign company with a British name, had proved a most unfortunate one to the Corporation," the loss incurred representing some £500.

Whitwood.—The B. of T. has asked the U.D.C. what steps have been taken to carry out the E.L. Order, 1905, and the Council proposes to ask for an extension of the order.

Wolverhampton.—For the purpose of supplying the Electric Construction Co., Ltd., the Corporation electric mains are to be extended from the works of T. Parker, Ltd., Wednesfield Road, to the borough boundary at Bushbury, at an estimated cost of £2,380. Nos. 1 and 2 turbo-alternators at the generating station, Commercial Road, are to be equipped with a system of forced ventilation at an estimated cost of £250; and two additional pairs of coking stokers are to be purchased from Hodgkinsons, Ltd., at the inclusive price of £277.

TRAMWAY and RAILWAY NOTES.

Dudley.—A special meeting of the T.C. was held last week to take steps for promoting a Bill in Parliament in order to give the Corporation power to purchase the tramways within the borough from the B.E.T. Co. and then lease them to that company in accordance with the famous contract dated August 1st, 1904. Alderman F. W. Cook said before they could arrange the lease they would have to promote a Bill in Parliament. This was because they desired that the lease should extend over 30 years. Under existing circumstances they could do this with regard to the light railways only, their powers with regard to the tramways being limited to 20 years. The tramway company, he added, had agreed to pay the taxed costs of the Bill, to which would be attached the provisions of the agreement. It was expected that the Bill would be passed by June, when they would pay the purchase money agreed upon, and the company would begin to pay as from the 7th of that month. He therefore proposed that they promote the Bill as previously agreed. This was seconded and carried unanimously. The Corporation, it may be added, is to pay some £71,000 for the lines within the borough and a certain amount of rolling stock. These the company will take on a lease of 30 years' duration, paying a rental which will recoup the Corporation for the cost of purchase and incidental expenses, including interest on the loan. The general effect of the transaction will be that in the year 1939 the Town Council will be the absolute possessors of the whole of the tramways within the borough, which the tenants will be ready to re-lease or surrender in good repair.

Dundee.—The Tramways Committee has decided against either the existing lines in Dens Road being extended or a trackless trolley service being put in operation there. The cost of extending the present service would be £1,450, while a trackless trolley service would cost approximately £250, and in addition, two cars at £700 each would be needed. The manager reports that while there can be no question as to the practicability of adopting the trackless trolley system, the revenue would not amount to anything approaching working expenses.

The income of the tramways department for the first half of the current year was £32,019, and the expenditure £19,978. The receipts were £1,454 more than at the corresponding period of last year.

Glasgow.—The Longside Ward Committee has under consideration the point of approaching the T.C. to lay a tramway to link up the eastern and western sides of the ward, and to run along the south side of the Queen's Park—a distance of about 1½ miles.

Some weeks ago a deputation of the Kirkintilloch T.C. approached the Tramways Committee asking that the tramways should be extended to that burgh, which lies about 3 miles from the present terminus at Bishopbriggs. The Merchants' Association of Kirkintilloch has, however, protested against the proposal on the ground that such an extension would be disastrous to the shopkeeping interests.

Hounslow.—The Heston and Isleworth U.D.C. intends to oppose the application by the London United Tramways Co. for Parliamentary powers to extend the time for commencing the line from Hounslow to Hanworth, and thence to Kempton Park. The Council will adhere to its resolution, passed at its last meeting, calling on the company to forthwith commence this line, together with that to Staines.

Isle of Man.—The Douglas Council has finally rejected the proposals of the Manx Electric Railway Co. for electrifying the horse section on the Douglas promenades, as it is considered inadvisable to lose control of the tramway service.

Liverpool.—The City Council on Friday agreed by 85 votes to 3, to the preamble of the Bill seeking further powers for the construction of tramways in the city and urban district of Huyton-with-Roby, and the power to run vehicles on the trackless trolley system on tramway routes. Notice has been given by the Huyton Council of its objection to the City Council constructing tramways in the area.

London.—A report of the Highways Committee, L.C.C., to come up at the next meeting, concerns the rearrangement of plant at the Elephant and Castle sub-station in order to provide sufficient power to work the Victoria Embankment tramways, which are at present supplied from the Holborn sub-station. It is proposed to install two 1,500-kw. motor-generators, instead of the existing four 300-kw. motor-generators, the latter being transferred to outlying sub-stations. The total cost of the work is estimated at £19,000. The Embankment cars run over the southern routes, and a fault occurring at the Holborn sub-station (which feeds the northern tramway routes), thus interferes with the working of the southern lines.

A statement as to the incidents which have occurred during the experimental working of the Mile End route has been submitted. Seven accidents are alleged to have occurred, presumably in connection with studs; only three claims were submitted, and these were settled for £60.

It is stated that Parliamentary powers are to be sought to extend the Charing Cross and Hampstead tube line to Watford. The L. and N.W. Euston and Watford line may be said to be under way, as although no electrical work is being carried out at present, yet a new double track has been constructed from Willesden to Watford, which will eventually form part of the electrified route. It is proposed to construct four new stations on this section, and it is probable that a steam-motor service will be run in the first instance.

Bermondsey.—The B.C. has formally consented to the electrification of the L.C.C. tramways from London Bridge to Deptford, subject to various street widenings being carried out at no expense to the Council. The estimated cost of the widenings in Bermondsey is £63,850, of which £46,250 represents the cost of acquiring property.

Newcastle-on-Tyne.—The interim report of the professional auditor to the City Corporation, for the half-year ended September 30th last, contains the following figures as to the electric tramways:—Receipts: Balance at March 31st, 1908, £14,986; traffic receipts, £99,439; capital expenditure repaid, £347; sundry receipts, £2,354; total, £117,126. Payments: Traffic expenses, maintenance, &c., £63,661; interest on loans, £16,639; loans repaid, £14,011; public lighting running cost, £484; total, £94,795. Balance at September 30th, 1908, £22,331.

Rochdale.—Negotiations are proceeding between the T.C. and the Milnrow U.D.C., with a view to running the Rochdale electric cars into the Milnrow district. Terms have already been submitted, and these will be considered at a future joint conference.

South Africa. — Port Elizabeth. — Owing to the recent flooding of the tramway power station and the consequent stopping of the tramway service, the municipal electric power station is now supplying energy to the tramway company until the plant of the latter can be put in running order again. The repairs at the tramway power station are, in the meantime, proceeding apace. The plant of the Harbour Board, which was also considerably damaged, is now so far repaired that the work of the Port is proceeding as usual, and the electric light and hydraulic power at the jetties are again available.

Southport.—At the meeting of the T.C. on Tuesday evening, a proposal was made to inaugurate a Sunday service on the Corporation tramways, but it was defeated by an overwhelming majority. It was, however, resolved that a plebiscite of the ratepayers should be taken on the question, with the consent of the Council. It is pointed out by the manager of the Corporation system that interest and sinking fund cost the Corporation £19 10s. per day, so that by not running the cars on Sunday, Southport pays £1,014 per annum for a period during which the system is idle. It was averred by Councillor Shuttleworth that the tramways would not make Southport any more noisy, and it was shown that on the pier the electric tramway running to the jetty was largely patronised on Sundays, while hackney carriages were allowed to ply for hire on the Sabbath. The privately-owned company electric tramcars run on Sundays between Birkdale and London Square, yet in no part of Southport proper are they allowed to ply for hire or to stop to pick up passengers, all fares having to be collected in Birkdale. The Corporation has to supply the company with electric power every day of the year, but plying for hire in the borough on Sundays is prohibited by a clause in the agreement.

Twickenham.—The Highways Committee of the U.D.C. has reported upon its consideration of the reply of Sir Clifton Robinson to the Council's complaints; the Council adhered to its former views upon the methods on which the London United Company's system was run. The U.D.C. also passed a resolution agreeing with the decision of the Conference at Ealing to approach the B. of T. with a request that the noise of the cars should be abated and the condition of the cars and track occasionally officially inspected. The Council has also decided to oppose the application of the London United Electric Tramways Co. for powers to extend its line along the Hanworth Road to Hanworth and Sunbury, the Act for which expired in 1901.

United States. — It is reported that a new electric motor-cab is in course of construction at the works at Orange, New York, U.S.A., of Mr. Thomas A. Edison. The vehicle will be fitted with a battery of Edison accumulators, which are stated to have now been perfected.

Wolverhampton.—Two years ago an agreement was entered into between the Corporation and the British Electric Traction Co. for the running of through cars between Wolverhampton and Dudley. This was effected by the Corporation cars being equipped with trolley poles for the overhead system of traction from the borough boundary to Dudley, and the B.E.T. cars being equipped with skates for the Lorain system of traction within the borough. This means of intercommunication is now, however, to cease, and after January 10th the Corporation cars will run only to the borough boundary, where, at great inconvenience, passengers will have to change to B.E.T. cars to take them further on. This is

the outcome of a communication which has been received from the B.E.T. Co., in which Mr. Lycett explains the circumstances as follows to the town clerk of Wolverhampton:—

As I have previously intimated to you, the arrangement by which the company is running a through service of cars from Dudley to Wolverhampton is one which, unfortunately, causes a loss to the company, and in pursuance of the interview which Mr. Cramp and I had with you on the 8th inst., I am putting forward in this letter the following statement, in the hope that some better and more mutual scheme can be adopted.

The arrangement by which the company's cars operate in Wolverhampton, is, as you well know, brought about by our equipping the latter with the Lorain skate, and it is principally this that has, so far, made the experiment practically unprofitable to us. The additional weight (nearly 1 ton) thereby thrown on the cars has increased the consumption of current by ·30 of a unit per car-mile, and the constant repairs necessary for the skate equipment has further increased our expenses, due somewhat to our having to fit such equipment to trucks which were not originally designed for the purpose.

Further, what is more peculiar, is the fact that our revenues have not in the least improved by the arrangement; so that altogether, what with the heavy increase in expenses and the falling revenue, my company are now compelled to approach you and solicit your kind consideration to review the situation.

An alternative scheme to run the Corporation cars through to Edgley was considered, but it was found that this could only be done at a great loss, and accordingly intercommunication is to cease. The Corporation Tramways Committee expresses its appreciation of the "friendly spirit" of the company, and it states that the comfort and convenience of intending through passengers will be secured as far as possible.

TELEGRAPH and TELEPHONE NOTES.

Atlantic Cable Rates.—Arrangements have been made for representatives of the British and Canadian Governments to meet in the spring to consider the subject of Atlantic cable rates.

Cable Rates Reform.—A public meeting at the Mansion House was held on Friday last, the Lord Mayor presiding, supported by many well-known men. In opening the proceedings, the Lord Mayor said that the subject was one of great Imperial importance, and that nothing was more deserving of assistance than the perfecting of facilities for inter-communication between parts of the Empire.

Sir E. Sassoon stated that he regarded cheap telegraphy as easy of accomplishment, and saw no reason why it should not be at once secured so as to enable the masses to use the telegraphs. It was of the utmost necessity to knit together the scattered parts of our Empire, and Lord Curzon was of opinion that nothing would tend more in this direction than cheap cable rates. The cost of telegraphy was not so material to the merchant as to the masses. Codes would be less in use if rates were lower, and he compared the French Government rate of ½d. per word with the British Colonial rates. After dealing with Sir J. Wolfe Barry's well-known objections, the question of the Pacific Cable so-called deficit came under review. He showed that there was a reserve fund of £171,000, and that full provision was being made for the redemption of capital within a stated period, and claimed that even in its present truncated position, the cable was paying its way. With regard to the Indian rate, this was reduced from 4s. 7d. to 2s., and this was still an elastic rate. The Indian Government guaranteed a revenue of £365,000, and their first year's payment was £1,500, but since then the traffic had recovered, and that Government now paid nothing at all. He desired an immediate reduction to 1s. 6d. per word, and the introduction of deferred messages at 1s. a word.

The Hon. R. Lemieux generally discussed and traced Canada's early efforts towards the nationalisation of cables, and the cheaper communication by ships and cables. He saw little or no Colonial news in English papers, and desired to furnish a remedy, especially in a State-owned Atlantic cable, which he thought feasible, profitable and a fit subject for a Conference. The public should not be deceived by a so-called loss on the Pacific cable; their own auditor-general affirmed that the Pacific cable was in a sound financial condition.

The Agent-General for the Australian Commonwealth, Capt. Collins, expressed entire sympathy, and stated that the Postmaster-General of the Commonwealth was in favour of cheapening cable rates as far as possible on sound business lines, and his Government, while reserving freedom in the matter, was in favour of co-operating with other Colonies in State-owned cables and bringing Canadian landlines under State control. The Duke of Argyll then moved the following resolution:—

"That this meeting, convinced of the desirability and necessity to manifold Imperial interests of a system of low-priced, easy and uniform means of telegraphic connection within the Empire, pledges itself to support the efforts of the Cable Committee of members of Parliament with that supreme object in view."

Lord Milner, in seconding, referred to the great importance of freer intercourse, and said that dispatches, Press and otherwise, should be extended and made intelligible, so that they would reflect full and correct views from friendly channels. Curtailed messages consequent on excessive charges were often misleading.

The resolution was carried unanimously.

The President of the London Chamber of Commerce, in a well-informed speech, proposed: "That this meeting, composed of representatives of commercial and industrial interests, respectfully suggests to H.M. Government the convening of a conference of Postal authorities of the States and Dependencies within the Empire for the purpose of concerting measures tending to the wider recognition of the policy of State-owned and State-controlled cables, subject to respect for private rights."

The resolution was seconded by Lord Jersey. Mr. G. R. Neilson proposed an amendment, which was ruled out of order as a direct negative; but speaking against the resolution, he pointed out the great obstacles to the scheme, due to the fact that many of the submarine cables landed on foreign shores, and that other Governments might not agree to allow the British Government to work them. He said that the British cable network was regarded with intense jealousy on the Continent, and questioned whether the Government would work the cables as cheaply as private enterprise, while the cost of new cables would be enormous. The proposal to establish "penny-a-word telegrams" had been killed by publicity.

The resolution was carried by a large majority.

The Right Hon. Jesse Collings moved the following resolution, which was seconded by Mr. T. P. O'Connor, M.P., and carried:—"That the Prime Minister be asked to receive a deputation early next session composed of influential men in the commercial, industrial and banking enterprises of the Empire, with the view of submitting the foregoing resolutions to the urgent attention of H.M. Government."

The Hon. W. S. Fielding, Canadian Financial Minister, stated that, although he would probably have to find the money, he was in favour of the State-owned cable.

Magnetic Survey.—A correspondent of the *Times* states that Profs. Thomson and Beattie are about to undertake a magnetic survey through Africa. The expedition is due to the generosity of the Carnegie Institute, and is likely to occupy a year.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Port Arthur-Chifu	Mar. 9, 1904 ..	..
Pontianak-Saigon	Sept. 16, 1908 ..	..
Dakar-Conakry	Nov. 6, 1908 ..	..
Zanzibar-Mombassa	Dec. 11, 1908 ..	Dec. 12, 1908

Telephone Courtesy.—The Post Office authorities, says the *Daily Telegraph*, have issued a long notice headed "Standard Expressions to be Used by Telephonists Engaged on Trunk Work," "in order that abrupt and uncouth expressions may be avoided in the telephone service."

The official preceptor of polite manners lays stress upon the advisability of using the word "please" wherever it can be conveniently introduced. Thus the instructions state: "A telephonist at the position answering a call, should announce her presence by saying, "Trunk number, please." Failing to hear what the subscriber says, she should say, "Please repeat," and so on. When a subscriber's attention has been obtained for a trunk call, the telephonist should say, "What is your number, please?" If a subscriber has been kept waiting for more than the regulation time, the telephonist should add, "Sorry to have kept you waiting."

At the end of a call, the telephonist is urged, when notifying a subscriber that his three minutes are up, to suggest that he should take another three minutes.

It is to be regretted that a code of suitable and adequate remarks has not yet been compiled for the use of subscribers, who are compelled to rely upon their own resources.

Wireless Telegraphy.—Referring to our note on the new Post Office station at Bolt Head, we are informed that the whole of the wireless equipment was manufactured and installed by Messrs. Marconi's Wireless Telegraph Co., Ltd., under their own patents only, and that the guaranteed range (250 miles) has been greatly exceeded, messages having been exchanged with the similar station of the Dutch Government at Scheveningen, 375 miles distant. The power plant—engine, dynamo, alternator, switchboard and battery—was supplied and installed by the Westminster Engineering Co., Ltd., to the specification of the General Post Office.

On Friday last the P.M.G. inspected and opened the new wireless station of the Post Office at Bolt Head. In the course of a speech, he said that the Government, as parties to the Radio-Telegraphic Convention, were obliged to have a station of their own, not only to carry out their own obligations, but also to enforce them elsewhere. They were determined to see that nothing in the nature of a monopoly of wireless telegraphy grew up. The system was at present available only for a limited number of purposes, of which communication with ships was the chief, and it suffered from the lack of privacy. He eulogised the work of the British delegates at the Radio-Telegraphic Convention, and stated that the Marconi Co., at first hostile to the Convention, was now on good terms with the Government, and had erected that wireless station. Mr. Buxton expressly thanked Lieut. Loring, Mr. Robb, and Capt. Ponsonby for their work in connection with the equipment of the station. Sir H. Babington-Smith also spoke, complimenting Mr. Buxton on his enlightened policy. Telegrams were exchanged with various wireless stations, including the Lizard, Guernsey, and Ushant.

The charges per word for communication with ships through the post office station at Bolt Head, will be generally 8d. per word, 3½d. of which is for the coast station, 4d. for the ship, and ½d. for the Inland telegraph charge. The Post Office will publish a list of ships which may be reached by wireless from Bolt Head. It would appear that "1d. per word" is not yet in the mind of the Postal authorities, even for "wireless" short-range telegrams. The charge for trans-Atlantic messages *vid* Lizard is 1s. per word.

Up to April 30th next the steamers of the Allan, Dominion and Canadian Pacific lines may be reached by wireless telegraphy from St. John, New Brunswick, when within 10 hours' steam of the port, or after they have left the port for the same period.

An agreement between the Admiralty and the Aberdeen Corporation, regarding the wireless telegraph station near the city, states that the Council has to provide a supply of energy in the form of

three-phase current at 100 volts; the rate is fixed at 3½d. per unit, with a minimum charge of £350 per annum. The sum of £1,000 towards the expense of laying the feeder will be paid by the Admiralty, who also pay the Corporation a further sum of £195 as the cost of installing underground telephone cables. The agreement is for five years.

Wireless Telephony.—The Radio-Telephone Co., of New York, N.Y., which operates the De Forest system of wireless telephony, has applied for an injunction restraining the Collins Wireless Telephone Co., of Newark, N.J., from infringing on patent rights granted to John Stone Stone, for wireless telephones. The Radio-Telephone Co. also asks for an accounting. The De Forest Co. is operating under the patents granted to John Stone Stone, and these patents, it is asserted, cover the entire field of wireless telephony.—*Electrical Review and Western Electrician.*

CONTRACTS OPEN and CLOSED.

OPEN.

Algeria.—January 15th. Tenders are invited by the Bône municipal authorities for—(1) the construction and working of a central electric power station, and (2) the construction and working of an electric tramway. Copies of the projects, specifications, &c. (in French), may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Australia.—Sydney, N.S.W.—April 28th, 1909. The Postmaster-General requires tenders for the supply, erection, &c., of a branching metallic multiple magneto switchboard at the William Street telephone exchange, according to specification No. 236. Specification may be seen at the Electrical Review Office. Also see our "Official Notices" this week.

Sydney.—February 22nd. Five water-tube boilers, economisers, stokers, feed pumps, pipework, &c., for the Council's electricity department. See "Official Notices" December 11th.

Austria.—Trieste.—January 5th. The San Andreea dock authorities require tenders for 12 movable electric cranes. The Technische Abtheilung der Lagerhausverwaltung will deliver specifications at cost price.

Vienna.—December 21st. Tenders for 300,000 (A) porcelain insulators; 250,000 (B) porcelain insulators; 500,000 (C) porcelain insulators; 55,000 (D) porcelain insulators; 20,000 (G) porcelain insulators; 10,000 with enamelled cover (large); 5,000 with enamelled cover (small); are required by the Post-oeconomie-Verwaltung, Postgasse, 17, Wien I.

Vienna.—January 2nd, 1909. Tenders are required for electric lighting and lightning conductor installation for the Kindergarten Buildings, Vienna VII. Particulars on application at the Stadtbau-Amt Farhabtheilung II, Neues Rathaus.

Battersea.—December 22nd. Coal for the electricity department. See "Official Notices" December 4th.

Beckenham.—January 4th. Electricity meters for the U.D.C. See "Official Notices" to-day.

Belgium.—Brussels.—January 8th. The Palais de Cinquantenaire electric lighting installation is to be adjudicated on January 8th, 1909; a deposit of £18 is required. Specification No. 89 may be obtained for 3d. and plans for 4s. 2d., at 15, Rue des Augustins.

December 30th.—Tenders are being invited by the Société Nationale des Chemins de Fer Vicinaux, Brussels, for the overhead electrical equipment of the Bois-d'Haine-Familleureux and Carmières-Anderlues sections of the light electric railways in the Centre district. The specification can be obtained for 1 franc, and the complete collection of plans for 18 francs, from the offices of the company at 14, Rue de la Science, Brussels.

Bradford.—December 23rd. Two 3,000-kw. turbo-generators complete with condensing plants, motor-driven auxiliaries, and piping for the Corporation. See "Official Notices" December 11th.

Birmingham.—December 29th. Electric motors for the Corporation Supply Department. See "Official Notices" December 4th.

Douglas (Isle of Man).—December 31st. Tramway stores for the T.C. for a year. S. Robinson, Tramway Offices, Strathallan Crescent, Douglas.

Fareham.—January 20th. Three alternators and exciters, high and low-pressure switchboards, overhead travelling crane, for the Council. See "Official Notices" to-day.

France.—Paris.—December 22nd. The Colonial Galerie d'Orleans requires tenders for high-conductivity copper wire, destined for the Ivory Coast Post and Telegraph service.

Germany.—Bischofswerder (West Prussia).—The municipal authorities are about to invite tenders for the establishment of a central electric lighting station in the town.

Leipzig.—February 5th. The switchgear for the central station and for six smaller works is advertised. Tenders will be received by the Rat der Stadt Leipzig, Amt für die Städtischen Technischen Werke, where specifications may be obtained at a cost of £1, and plans at £2 10s.

Graigola.—December 20th. Electrical goods for six months. Graigola Merthyr Co., Ltd., Cambrian Place, Swansea.

Hull.—Pipes, fittings, &c., for new engine and condensing plant, foundations for engine and dynamo and condensing plant, new pump room, &c., at tramway power station. A. E. White, City Engineer, Town Hall, Hull.

Italy.—Rome.—February 8th. Tenders are required for the lighting of the Palais de Justice, including fittings. Inquiry must be made, through local agent, at the chief engineer's office for the General Service of Rome, at Department of Public Instruction.

Kilmarnock.—The Corporation invites tenders for the electric lighting of the infectious diseases hospital; conditions from the electricity works; tenders to W. Middlemas, Town Clerk.

Leith.—January 6th. One 600-kw. steam dynamo for the Corporation electricity department. See "Official Notices" to-day.

Manchester.—December 18th. Foundation work for a 6,000-kw. turbo-generator set, pipe trench, and extensions to air filter house, required at Stuart Street generating station. Particulars from Secretary to the electricity department.

December 23rd.—(1) Wiring and complete electric light installation; (2) electric bells and telephones at Bradford Baths, for the T.C. (£2 2s. deposit each contract). City Architect, Town Hall.

Middlesbrough.—December 30th. Twenty flame arc lamps, posts, &c., for street lighting. See "Official Notices" to-day.

Neath.—December 22nd. 2,500 tons of coal for the R.D.C. electricity works. G. H. Thomas, Electrical Engineer, 12, Green Street, Neath.

Portsmouth.—January 4th. Materials for Corporation tramways construction. See "Official Notices" to-day.

Rixdorf.—January 6th. Tenders are required by the magistrate for light and power works at the municipal hospital in Neu-Buckow bei Brietz. Particulars may be obtained, for 3s., at the Rathaus.

Russia.—St. Petersburg.—December 21st. The administration of the municipal telephone service, Morskaja 22, requires tenders for lead-covered, paper-insulated telephone cables.

Baku.—January 24th. The T.C. is inviting tenders for its electric tramway concession (42 years). Full particulars at the Russian Consulate in London.

Spain.—San Feliu de Guixola (Province of Gerona).—December 24th. Tenders are being invited by the municipal authorities for the concession for the electric lighting of the town during a period of 10 years. Particulars may be obtained, and tenders are to be sent to, El Secretario del Ayuntamiento de San Feliu de Guixola (Gerona).

Wigan.—December 21st. Stores for the E.L. and tramway departments for the T.C. J. Slevin, Engineer and Manager.

CLOSED.

Belgium.—Six firms submitted tenders to the Société Nationale des Chemins de Fer Vicinaux, of Brussels, for the electrical equipment of four sub-stations for transforming high-tension alternating three-phase current to continuous current, directly utilisable for tramway traction purposes on the lines in the Centre district. Les Ateliers de Constructions Electriques, of Charleroi, quoted £7,418 and £6,809, according to the scheme selected; La Compagnie Belge d'Electricité Siemens-Schuckert, Brussels, £8,800, £8,760 and £7,460; La Compagnie Internationale d'Electricité, of Liège, £9,620, £8,800 and £8,768; the A.E.G. Union Electrique, Brussels, £10,674 and £10,514; Messrs. Brown, Boveri & Co., of Baden, £12,177 and £10,947; and Messrs. Conforti and Co., of St. Josse-ten-Noode, £12,605.

Cardiff.—The electrical engineer is to purchase from Mr. A. G. Brown, of Manchester, at £80, a vacuum and pressure dry insulating machine, varnish tank and pump, for use in connection with the re-insulation of armatures and field coils. Two patent rail grinders, fitted with carborundum blocks, are to be purchased from the National Rail & Tramway Appliance Co., Ltd., Liverpool, at £25 each.

Croydon.—The tender of Messrs. W. J. Bishop & Co., Croydon, was accepted for wiring and fitting the new central office and showrooms of the B.C. electricity department (£59).

Darlington.—The T.C. has accepted the tender of Messrs. Cox-Walkers for an electrically-driven pump, at £168.

Leith.—Messrs. Thermit, Ltd., have received the order for welding the rails on the tramway extension to be carried out by the Corporation. There will be about six miles of single track.

London.—L.C.C.—The Stores Committee recommended for acceptance at Tuesday's Council meeting the following tenders:

British Westinghouse Co.—Schedule No. 6 C, item 5.
B. I. & H. Cables, Ltd.—Schedule No. 6 D, items 20 and 24.
G. MacLellan & Co.—India-rubber.
Western Electric Co.—Electric cables and wires.
W. Geipel & Co.—Electric insulating materials.
G. Schultz & Co.—Electric insulating materials.
Taylor & Co.—Electric insulating materials.

The Fire Brigade Committee recommended that the Camden Town fire station, now lighted by gas, should be lighted by electricity. The following tenders were received in response to an invitation to selected firms:—

Tredegar & Co. ..	(accepted)	£166	Chas. Pullan		£235
Nursey & Marr		175	W. Leonard & Co.		275
W. J. Fryer & Co.		193	Engineer's estimate		202

The L.C.C. has received offers from the following firms for the purchase of the battery not required at the Crossness Outfall Works, in consequence of the decision to take supply from the Erith U.D.C.:—

E. J. Webster, Stratford	(accepted)	£205	Premier Accumulator Co. ..	£150
Hart Accumulator Co. (about £7 10s. per ton)		200	E.P.S. Co.	110

For structural work required in altering the Victoria Embankment generating station to adapt the premises for use as offices, the tender of Messrs. F. & H. F. Higgs, at £1,080, is recommended for acceptance.

The Highways Committee report that they have considered the tenders for the roadwork and platelaying, exclusive of the supply of rails and special trackwork, in connection with the reconstruction, on the underground conduit system of electric traction, of the existing tramways from Hackney Road, *via* Mare Street and Lower and Upper Clapton Roads, to Stamford Hill, and the construction on the same system of traction, of the authorised tramway in Amhurst Road and Dalston Lane. The tenders also contain provision for the execution of certain paving works outside the tramway tracks in connection with the widenings along the route.

		Tramway works.	Paving works.	Total.
Dick, Kerr & Co.	(accepted)	£78,877	£3,838	£82,715
W. Manders		80,353	3,960	84,334
A. M. Coles		81,687	2,869	84,556
J. Mowlem & Co.		84,496	4,169	88,665

The chief engineer's estimates, comparable with the tenders, are £84,091 for tramway works, and £3,887 for paving works, a total of £87,978. Provisional sums, amounting to £15,700, are included in each of the tenders for alterations of pipes, mains, &c., the cost of which works cannot be more accurately estimated beforehand, and a sum of £5,000 is also included for any other contingencies which may arise. It is a condition of the contract that Messrs. Dick, Kerr agree to give preference in employment on casual or unskilled labour required for the work to men *bond fide* resident in the County of London. Messrs. Dick, Kerr are to be allowed to sub-let to the undermentioned firms the following portions of the work:—

Yokes.—Anderston Foundry Co. or Wilsons, Pease & Co.
Insulators.—Doulton & Co. or Bullers, Ltd.
Tiebars, bolts, &c.—Bayliss, Jones & Bayli s or Guest, Keen & Nettlefold.
Cement.—Associated Portland Cement Manufacturers, Ltd.
Plough boxes and drain boxes.—Harrison & Co. (Lincoln), Ltd., and Hadfield's Steel Foundry Co.
Bonds.—Forest City Electric Co.

Tenders are to be accepted for materials required in the manufacture of 2,500 ticket punches by the staff of the Tramways Department.

Stepney.—For the supply of rubber cable the Council received the following tenders:—

Baxter & Caunter ..	(accepted)	£87	W. T. Glover & Co.	£107
W. T. Henley's Teleg. Works Co.		107	I.-R. G.-P. & T. Works Co. ..	107

The Council is willing to allow the British Fuel Economiser and Smoke Preventer Co. to continue experiments with its two sets of smoke prevention apparatus at the electricity works for another month if it desires.

Portsmouth.—The T.C. has accepted the tender of Messrs. Steel, Peech & Tozer, Ltd., for 200 steel tramway tires, at £1 10s. 9d. per tire; and of Siemens Bros. Dynamo Works, Ltd., for the alteration of a turbo-generator from a capacity of 500 kw. to one of 650 kw., at a cost of £1,045.

Sheffield.—The City Council on December 9th confirmed the Tramways Committee's acceptance of the tender of Messrs. Browett, Lindley & Co., Ltd., of Patricroft, for the supply and erection of one of their 1,500-kw. triple-expansion quick-revolution forced-lubrication engines coupled to an Electric Construction Co.'s generator. Messrs. Browett, Lindley have recently installed a 1,000-kw. generating set in the same station.

Skegness.—The U.D.C. has adopted the scheme of Messrs. Manlove, Alliott & Co., Ltd., for a refuse destructor, at a cost of £1,696.

Stalybridge.—The Stalybridge, Hyde, Mossley and Dukinfield Joint Tramways and Electricity Board has accepted the tender of Messrs. Thos. Beeley & Son, Ltd., for a superheater and pipework.

Stockport.—The order for 53 motors, starting panels and main switchboard for their new works has been placed by Messrs. John Horn (Stockport), Ltd., with Messrs. Veritys, Ltd., Manchester.

Wolverhampton.—The T.C. has accepted the tender of the Electric Construction Co., Ltd., for switchgear and accessories, at £120; and that of Messrs. Hodgkinsons, Ltd., for two pairs coking stoves, at £277.

CONTRACTORS' COLUMN.

The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERAVON (Glam.).—Prospective re-building, after fire, of the Jersey Beach Hotel.

ABERBARGOED (Mon.).—County school. J. Bain, architect, Arcade Chambers, High Street, Newport, Mon.

ABERDARE.—Receiving home; T. Roderick, architect, Aberdare. Dwellings (£10,000); O. Williams, architect, Town Hall, Aberdare.

ABERDEEN.—Hall for St. Margaret's Episcopal Church; G. G. Irvine, architect, 231A, Union Street, Aberdeen. Alterations and additions at 18-22, Market Street, for W. Smith & Son, nurserymen; Kelly & Nicoll, architects, 367, Union Street, Aberdeen. Premises for J. Cordiner & Son, boxmakers; J. Reid, manager. Proposed technical college; city architect, Aberdeen. Two houses in Devanha Gardens; D. & J. R. McMillan, architects, 105, Crown Street, Aberdeen.

ABERYSTWYTH.—Temporary premises for Welsh National Library. J. Ballinger, librarian, Welsh National Library, Aberystwyth.

ACCRINGTON.—Houses (15), Harcourt Road, for Oldham Bros.

ALDEBURGH-ON-SEA.—Bungalow. H. S. Watling, architect, Kingsway House, Dovercourt, Harwich.

AMERSHAM.—Houses, Hyde Heath, for S. Fassnidge: Bois Farm Estate, for H. Kennard; Prestwood, for L. J. Graves; Amersham, for White, Son & Co.

ARBROATH.—Store, and alterations to premises in Fergus Road, for the Equitable Co-operative Society.

ASHTON-UNDER-LYNE.—Probable re-erection (after fire) of cardroom, &c., at Ryecroft Mills, for Abel Buckley & Co.

AYR.—New premises for Young Men's Christian Association (£5,000). The Secretary, Y.M.C.A., Ayr.

BARGOED.—New higher elementary school. T. Mansel Franklin, Clerk to County Council, Cardiff.

BARNSLEY.—New school at Worsborough Dale, for the West Riding of Yorks. C.C. J. Vickers-Edwards, County architect, Wakefield.

BARWICK-IN-ELMET (near Leeds).—New offices for the Parish Council. H. M. Chippindale, architect, Scholes, Leeds.

BECKENHAM.—Iron mission room, corner of Chaffinch and Beckenham Roads; Rev. Canon Arnott, Beckenham Rectory; W. Harbrow, builder.

BELFAST.—Extensions to Union recommended (£11,620).

BELPER.—Higher grade school, pupil teachers' centre, and baths, (£20,000); given by Geo. H. Strutt, J.P., Mackeney House, Derby.

BERKHAMSTED.—School at Whelpley Hill, Ashley Green, for Bucks. C.C. C. G. Watkins, Education Office, Aylesbury.

BEXHILL.—Proposed enlargement of the shelter hall, Egerton Park.

BILSTON.—New Roman Catholic School (£2,000).

BIRMINGHAM.—Prospective restoration, after fire, of portion of tube works, Nile Street, for Grice, Grice & Son.

BLACKBURN.—Probable re-erection (after fire) of warehouse, for Duckworth and Eddleston, Carr Cottage Cotton Mills.

BLACKPOOL.—New hotel, café and restaurant (£300,000). Blackpool Café and Hotel Co., Ltd.

BOLTON.—Probable re-erection of works, for Jackson Bros., iron founders proposed further additions to workhouse, Board of Guardians; extensions to Daroy Lever Wesleyan Schools, Trustees.

BO'NESS (N.B.).—Proposed Public Baths, for the T.C.

BOURNEMOUTH.—New school (650 places); A. J. Lacey, architect, Municipal Buildings, Bournemouth. Shelters, offices, &c., West Cliff; F. W. Lacey, borough surveyor, Bournemouth.

BRADFORD.—New block for male phthisis patients, and administrative block for 300 inmates, for the B.G.

BRENTWOOD.—Conversion of swimming bath into infants' school, for the Hackney Union. F. R. Coles, clerk to the Guardians, Sidney Road, Homerton, N.E.

BRETHERTON (near Preston).—Additions to the parish church (£1,200). J. Hatch & Sons, builders, Queen's Place, Lancaster.

BRIDGWATER.—Council School at Somerset Bridge, for Somerset C.C. Cottam & Samson, architects, Bridgwater.

BRIGHTON (Hove).—Proposed extension of the Sanatorium (£6,000).

BROMLEY.—Houses, Waldegrave Road, for Thompson & Walford; Liddon Road, P. Coad, architect, 101, Mason's Hill, Bromley; Garden Road, L. Evans, builder, 6, Sunbridge Parade, Plaistow Lane; Salisbury Road, for E. W. Thomsett; London Lane, J. Palin, builder, 22, Farwig Lane.

BROMSGROVE.—Prospective restoration, after fire, of buildings at the Salt Union Works, Stoke Prior.

BROUGHTON (Hants.).—New Council School. W. J. Taylor, county surveyor, The Castle, Winchester.

BURNLEY.—Extensions at Hope Weaving Mill. Trafalgar Mill Co.

BURTON-ON-TRENT.—Works at Shobnall, for Fred. R. Jones & Co., silicate cotton manufacturers, Perrin Street, Kentish Town, London.

BUXTON.—Extension of Upper End Primitive Methodist Church and Schools G. E. Garlick, architect, The Quadrant, Buxton. Two houses, Holker Road, for J. W. Simpson.

CAERPHILLY.—Two chapels at Taff's Well and Penyrheol Cemeteries. Sidney Williams, architect, Caerphilly.

CAHIRCIVEEN (Co. Kerry).—New free library. R. M. Butler, architect, Dublin.

CAMBRIDGE.—Agricultural College; A. Mitchell, architect, 17, Hanover Square, W.; Messrs. Pringle, builders, Cambridge. School (£15,000); Mr. Julian, surveyor to Town Council.

CARRON (Aberdeenshire).—Proposed new hall (£300). Secretary, Hall Committee.

CHALFONT ST. PETER (Bucks.).—Houses, Chalfont Commons, for C. Hearn; Chalfont St. Peter, for F. Wood, Robinson and Roods, and L. P. Kirkham.

CHEADLE.—Houses, Victoria Avenue, Cheadle Hulme, for C. Gradwell; shops and houses, High Street, for T. Hulme.

CHELTENHAM.—Sewerage works for the T.C. (£11,656). Mark Williams and Co., contractors, Cheltenham.

CHESTERFIELD.—Probable reinstatement (after fire) of sweet factory, Park Road; J. H. Toplis, chemist, Chesterfield, owner; J. W. Wardell, occupier.

CHICHESTER.—Large stores and motor garage, Crane Street; Vick & Son, Chichester. Proposed Council schools, Orchard Street (760 scholars); H. P. Roberts, architect to the West Sussex Education Committee. Alterations to Oaklands Park House; Holt and Sons, builders.

CHRISTCHURCH (HANTS.).—Infirmary at the workhouse. A. Druitt, clerk to the Guardians, Christchurch.

CLEATOR.—School for 330 children, for Cumberland C.C. G. D. Oliver, county architect, Carlisle.

CLECKHEATON.—Proposed public baths at Wyke. City architect.

CLITHEROE.—Important alterations at the local vicarage and parish schools.

COLCHESTER.—Co-operative stores and premises. Goodey & Cressall, architects, High Street, Colchester.

COLWYN BAY.—English Congregational Church at Rhos-on-Sea.

COWDENBEATH (FIFE).—Rescue station for Fife and Clackmannan Coal-owners' Association (£1,600). David B. Campbell, architect, Cowdenbeath.

CROYDON.—Twenty-three houses, Tylecroft Road; C. Spencer, Elmwood Road. Additions to Stanley Hall, South Norwood; W. T. Stanley, Cumberlow, South Norwood. 10 houses and shops, Wickham Road; R. G. Ellis, architect, 17, Clarendon Road. Three houses, Quadrant Road; G. H. Paine, architect, 62, Moorgate Street, E.C. Entertainment hall, North End; A. Broad, architect, 22, George Street, Croydon. 12 houses, Woodside Court Road; Pepler & Allen, architects, 3, George Street, Croydon.

CRAGHEAD (Co. DURHAM).—New church; Rev. W. Chapman, minister, Craghead.

CWMAVON.—Twenty houses on Whitworth Estate. T. B. Smith, architect, Port Talbot.

DARLINGTON.—Houses, Crosby Street, Westgarth Terrace, and Reid Street, for J. E. Chilton; Falmer Road, for E. W. Lyall, surveyor, 39, Northgate; Lowes Road, for G. Dickinson & Son; Langholm Crescent, for J. P. Prichett & Son; conversion of house into shop, Surtees Street, for G. W. Davis; additions to premises, Valley Street North, Kitching & Lee, architects.

DARTFORD.—Two pairs of houses (£1,340), for G. Tomlinson; T. Woollier, 31, Priory Villa, West Hill; W. F. Blay, Ltd., builders. Houses, Old Recreation Ground, for J. Hobbs; Shepherd's Lane, for Webb & Neilson; steel buildings, Victoria Wharf, for the Acme Bottle Manufacturing Co.

DARWEN.—New brickworks. Messrs. Shaw.

DEAL.—Extensive alterations to business premises for C. R. Darracott, jeweller, 58, High Street.

DEOPHAM.—County school. Education architect, Shire Hall, Norwich.

DERBY.—Club house at Markeaton, for the Derbyshire Golf Club. Thorpe and Fryer, architects, Derby.

DEVONPORT.—Church. G. H. F. Prynne, architect, 6, Queen Anne's Gate, S.W.

DONCASTER.—Business premises, French Gate, for W. Burdett, and G. F. Hather; E. Wilburn, architect, St. George Gate, Doncaster.

DOVER.—Important extension of the Admiralty Pier, for the Harbour Board. Pearson & Son, Ltd., contractors, London.

DOVERCOURT.—Six houses. H. S. Watling, architect, Kingsway House, Dovercourt.

DUBLIN.—Repairs to three dispensaries, for the South Dublin Union. J. P. Condon, Clerk to the Union, 1, James's Street, Dublin.

DUNFERMLINE.—Alterations to property, for H. B. Grier, Abbey Park Place; alterations to Green Tree Tavern, Bruce Street; proposed new offices for Fife and Kinross Miners' Association, The Secretary.

DURHAM.—Nine houses, Sherburn Hill, for the Lambton Collieries, Ltd.

EDGELEY (near STOCKPORT).—New Primitive Methodist Church. Trustees.

EDINBURGH.—Two tenements at Stockbridge, for St. Cuthbert's Co-operative Society, Ltd.; eight villas off Kilmaurs Road, for G. Mackay; additions to premises in Ponton Street, Fountain Bridge, for Governors of Industrial Brigade Home.

ELLAND.—New Territorial drill hall in Jepson Lane.

ELTHAM.—Fifteen houses in North Park Road. Whistler & Worge, surveyors, 80, High Street, Eltham.

ETON.—Probable re-erection (after fire) of business premises, 126, High Street. Provost and Fellows of Eton College, owners; F. Wilkinson, lessee.

EVESHAM.—Seven houses, Windsor Road, Greenhill. Espley & Co., Ltd., builders.

FAKENHAM.—School. H. Green, architect, Norwich.

FELTHAM (MIDDLESEX).—Enlargement of Council School. A. & B. Hanson, builders, Southall, W.

FERMOY.—Prospective rebuilding, after fire, of Moore Park House (mansion), Kilworth.

FINGHALL (YORKS.).—New Chapel. Robert Metcalfe, Spruce Gill, Finghall.

FLEETWOOD.—Suites of offices at the Docks. L. & Y. Railway Co., Hunts Bank, Manchester.

FOLKESTONE.—Library. A. E. Nicholls, borough surveyor, Folkestone.

FRINTON-ON-SEA.—Detached houses, Winchester Road, for Rev. E. Blakeway.

GLASGOW (POLLOKSHAWS).—Alterations to West United Free Church and new hall in connection with the same. Rev. W. McAlpine, minister.

Houses and shop, off Kirkintilloch Road, Bishopbriggs, for G. S. Campbell, Auchinairn Road, Bishopbriggs; alterations at Glenfarg Villa, Lenzie Road, Stepps, for Jas. Smith; villa, off Brackenbrae Road, Bishopbriggs, for J. Marshall & Sons, Bishopbriggs; villa, Crosshill Road, Lenzie, for J. & R. Watson, Auchinloch.

GRANTHAM.—Extensions to Lord Harrowby Inn, Dudley Road, for H. Willmin; seven villas, Harrowby Road, for H. H. Bowler.

GRAVESEND.—Twelve houses, Campbell Road, for R. Henderson; Bridgland and Clay, architects.

GRETTON (near KETTERING).—Council Schools (£3,075). O. P. Drever, builder, Round Hill Road, Kettering.

HAMPTON.—Stabling and garage at the Red Lion Hotel.

HEALING (LINCOLNSHIRE).—Elementary School and Teachers' House. Scorer and Gamble, architects, Bank Street Chambers, Lincoln.

HEMEL HEMPSTEAD.—Houses, Felden Heath, for H. Smith; Adeyfield, for T. Doult; King Edward Street, for T. C. Gold; Green End Road, for Gower Bros.

HEREFORD.—Alterations and additions to premises for the Rowing Club. E. G. Davies, architect, 132, Widemarsh Street, Hereford.

HESSLE (near HULL).—Houses, Salisbury Street. E. Hearfield, architect, Hull.

HETTON-LE-HOLE (Co. DURHAM).—Twenty houses, North Road, for Mr. Storey.

HINDLEY.—Extensions to be carried out at Hindley and Abram Grammar School. Governors.

HITCHIN.—Detached house, Highbury Road, for Mrs. Hill; W. Seymour and Son, architects. Motor garage, Walsworth Road, for R. E. Sanders & Son; J. Willmott & Sons, builders, 80, Walsworth Road.

HORBURY (near WAKEFIELD).—Business premises for the Horbury Industrial Co-operative Society.

HORNCASTLE (LINCS.).—New Grammar School (£4,500). Scorer & Gamble, architects, Bank Street, Lincoln; C. Hensman & Son, builders, Horncastle.

HOUGHTON-LE-SPRING.—Eleven houses, Burn Street, Wheler Street estate, for W. E. & M. P. Balmer; four houses, Bernard Street, for J. H. Wood.

INGOLDMELLS (LINCOLNSHIRE).—Elementary school and teachers' house. Scorer & Gamble, architects, Bank Street Chambers, Lincoln.

INVERURIE (N.B.).—Shops and houses in West High Street. Addison, merchant, Inverurie.

IPSWICH.—Detached house, Rushmere Road. H. S. Watling, architect, Kingsway House, Dovercourt, Harwich.

KEIGHLEY.—New school at Cononley, for the West Riding of Yorkshire C.C. J. Vickers-Edwards, County architect, Wakefield.

KEMPNALL (NORFOLK).—Institute and club house. E. Tench, architect, Norwich.

LANCASTER.—Lecture hall, &c. J. Parkinson, architect, 67, Church Street, Lancaster.

LEEDS.—Roller skating rink and large hall at the Olympia; I. Senior & Son, East Parade, Leeds. House, shop, &c., at Kirkstall; Fred Mitchell, architect, 9, Upper Fountaine Street, Albion Street, Leeds. Workhouse extensions (accommodate 200 extra persons); Board of Guardians. Handicraft centre and cookery room at Rodley School, for the Education Committee; Jas. Graham, Secretary for Education, Calverley Street, Leeds.

LEEK.—Underground convenience, corner of Brook and Crompton Streets. W. E. Beacham, surveyor to the U.D.C., Town Hall, Leek.

LEVEN.—Working men's home. C. G. Campbell, architect.

LINCOLN.—Proposed extension of the Girls' High School. A. C. Newman, Chairman of the Governors.

LISCARD (CHESHIRE).—Houses, Lodgewood Road. G. Bowyer, builder, Annesley Road, Seacombe.

LITTLE COATES (LINCOLNSHIRE).—Elementary School. Scorer & Gamble, architects, Bank Street Chambers, Lincoln.

LLANDUDNO.—Alterations and improvements to the Clarence Hotel, for C. Moses, proprietor; A. Hewitt, architect. Two villas, in Brynybia Road; Thorpe & Sons, builders. Alterations to Warren Mission Room; W. O. Williams, trustee, The Bon, Llandudno. Alteration and extension of showroom in Trysa Road, for F. Holland, china merchant.

LIVERPOOL.—Extension of premises, Bold Street, including rebuilding of adjoining shops, for Messrs. Boots, cash chemists.

LONDON (EAST HAM, E.).—Refreshment room, shelter, &c., in Central Park; A. H. Campbell, surveyor, Town Council. Five houses and one shop, Grosvenor Gardens; P. Herapath, builder, 121, Milton Avenue, East Ham. Fourteen houses and two shops, Boundary Road; W. G. Watson, builder, 2, Milton Avenue, East Ham.

(BARNES, S.W.).—Rifle range, Temple Sheen Road, for the Isleworth Brewery Co. Four houses, Temple Sheen Road; Tyers & Jago, architects, 10, John Street, Adelphi, W.C. Two houses and one shop, South Worple Way; C. Ellis & Co., builders, Portman Estate, East Sheen. New roads, Barker Estate, Blind Lane; Tyers & Jago, architects, 10, John Street, Adelphi, W.C.

(E.C.).—Prospective restoration, after fire, of 18, Dufferin Street, for Dancer & Andrews, stick manufacturers.

(CAMDEN TOWN, N.W.).—Buildings at corner of High Street and Kentish Town Road. D. Joseph, architect, 73, Basinghall Street, E.C.

(PADDINGTON, W.).—Extension of Technical Institute. T. J. Bailey, Education Architect, L.C.C. Offices, Victoria Embankment, W.C.

(BALHAM, S.W.).—Conversion of disused tramcar shed into skating rink. Mr. Bostock, 44, Kensington Mansions, S.W.

(POPLAR, E.).—Twelve houses, Tebb Street. E. Evans, surveyor, 258, Lavender Hill, S.W.

(HOLBORN, W.C.).—Building on site abutting upon Tottenham Court Road, Bedford Avenue, Caroline Street and Great Russell Street, for Central Young Men's Christian Association. R. Plumb, architect, 13, Fitzroy Square, W.

(W.).—New premises, 47, Baker Street, for The Floral Depôt; Messrs. Chessum, builders, 7a, South Place, E.C. Shop and premises, Marylebone Lane; B. E. Nightingale & Co., builders, Albert Embankment, S.E. Shops, &c., 89 and 40, New Bond Street; Smith & Sons, builders, South Norwood, S.E. New premises, North Audley Street and Lees Mews, for Mr. Hay, baker, &c.; Messrs. Garlick, builders, Sloane Street, S.W. Installation of electric light at Challis's Royal Hotel, Rupert Street; The Proprietor. Buildings at Fun City, Olympia; E. H. Payne, architect, 11, John Street, Bedford Row, W.C. Additions to Aylesbury Dairy Co.'s premises, St. Petersburgh Place; W. G. Keith, architect, 7, East India Avenue, E.C.

(GREENWICH, S.E.).—Rebuilding Hyde Cliff, Wellington Grove, in connection with Ursuline Convent. W. Nash, builder, Childers Street, Deptford.

(HAMMERSMITH, W.).—Nine houses and shops, also stable and workshop, in Askew Road, Hammersmith. S. H. Hannington.

(MARYLEBONE, W.).—Building in Lower William Street, Regent's Park. F. M. Elgood, architect, 98, Wimpole Street, W.

(POPLAR, E.).—Alterations at British Street School. T. J. Bailey, Education Architect, L.C.C. Offices, Victoria Embankment, W.C.

(PECKHAM, S.E.).—Cinematograph box at the Crown Theatre. F. Matcham & Co., architects, 9, Warwick Court, High Holborn, W.C.

(HACKNEY, N.E.).—Erection of laundry and housewifery centre at Upton House Truant School. T. J. Bailey, Education Architect, L.C.C. Offices, Victoria Embankment, W.C.

(VICTORIA EMBANKMENT, W.C.).—Adaptation of L.C.C. generating station and offices. F. & H. F. Higgs, builders, Hinton Road, Herne Hill, S.E.

(FINCHLEY, N.).—Thirty-six houses, Rosemount Avenue. C. F. Day, builders, 21, Regent's Park, Finchley.

(HENDON, N.W.).—Addition to Regent House, Great Stanmore, for Mr. Clutterbuck; alterations and additions, Leto works, Mead's Road, Little Stanmore, for R. E. Thomas. Alterations and additions to the workhouse, near Edgware; E. P. Thompson, architect, 25, Finsbury Square, E.C.

(LAMBETH, S.E.).—Additional lavatory accommodation at the workhouse, Princes' Road, Kennington Road; J. L. Goldspink, clerk to the Guardians, Guardians' Offices, Brook Street, Kennington Road, S.E. Factory, Somers Place, for the Trustees of the Stockwell Orphanage.

(WEST NORWOOD, S.E.).—Two houses, Canterbury Grove. H. Bignold, architect, 242, Lavender Hill, Clapham Junction, S.W.

(NORTH ACTON, W.).—Development of Park Royal Estate. Redfern and Hunt, solicitors, 13-14, Abchurch Lane, E.C.

(E.C.).—Bank and offices, Nos. 171-174, Aldersgate Street. Trollope and Colls, Ltd., builders, West Halkin Street, S.W.

(DEPTFORD, S.E.).—Shop and premises, 71, High Street. Messrs. H. L. Holloway, builders, Union Works, Church Street, Deptford, S.E.

(KING STREET, S.W.).—Alterations and additions at Blenheim Club. G. A. Lansdown, architect, 9, Regent Street, S.W.; J. Marsland and Sons, builders, 1, York Street, Walworth, S.E.

LONDON (WIMBLEDON, S.W.).—New Church of St. Andrew, Herbert Road. Rev. J. W. Maunders, vicar-designate.

(PECKHAM, S.E.).—Additions to premises of G. G. Bussey & Co., Ltd., Rye Lane.

(LEWISHAM, S.E.).—Five houses, Chalcroft Road. W. J. Scudamore and Sons, builders, 13, Manor Lane, S.E.

(BATTERSEA, S.W.).—Police station and quarters; J. Dixon Butler, architect, New Scotland Yard, S.W. Additions to Battersea Polytechnic, Battersea Park Road: Mountford & Clapham, architects, 13, Southampton Street, W.C.

LOWESTOFT.—Prospective rebuilding, after fire, of shipbuilding works for H. Reynolds & Son. Detached house, Oulton Broad; H. S. Watling, architect, Kingsway House, Dovercourt, Harwich.

LYMINGTON.—New Council School; W. J. Taylor, county surveyor, The Castle, Winchester. Alterations and additions to Efford Park; G. A. Lansdown, architect, 9, Regent Street, S.W.; Kirk and Kirk, builders, 17, Esher Street, Westminster, S.W.

LYNTON.—Church. L. Stokes, architect, 2, Great Smith Street, S.W.

MACCLESFIELD.—Two detached blocks at the Parkside Asylum; H. Beswick, county architect, Chester.

MANCHESTER.—Renovation of Patricroft Congregational Church (£600). Rev. J. Masterton, minister. Important alterations at the Railway Hotel, Cornwall Street, Gorton, for the Manchester Brewery Co., Ltd., New York Street, Ardwick.

MANSFIELD WOODHOUSE.—Sewerage scheme for the U.D.C. F. P. Cook, engineer, Leeming Street, Mansfield.

MARGATE.—Houses, Crawford Gardens, for R. Elliott; Victoria Avenue, for F. Miles; Grotto Hill, for F. Ward; additions to Zetland Lodge, Grosvenor Place, for W. H. Foxworthy.

MASBOROUGH.—Engine and generator houses, for the Equitable Pioneers' Society, Ltd. J. Platts, architect, High Street, Rotherham.

MERSTHAM (SURREY).—Additions to the Old Forge House, for Seymour Hicks; additions to house, Bletchingley Road, for Miss M. Pelly; two houses, Coppice Lea, for G. R. Hunt, C.C., Greenbank, Redhill.

MIDDLESBROUGH.—Renovation, and improved heating, lighting and ventilating at Newport Road Baptist Church.

MOUNTAIN ASH.—School, Miskin. A. Williams, architect, Council Offices, Mountain Ash.

NEATH.—Primitive Methodist Chapel at Skewen.

NETHERTON (FIFE).—Proposed new school. Wishaw School Board.

NEWCASTLE-UNDER-LYME.—Extensions in connection with Harpfield Primitive Methodist Church (100 more scholars).

NEWTONARDS (Co. DOWN).—Conversion of Presbyterian Church into Technical School.

NORTHAMPTON.—Hippodrome. B. Crewe, architect, 75, Shaftesbury Avenue, W.C.

Extensions at the General Hospital, including rebuilding and equipment of laundry (£6,700); Harry Manfield, chairman of Special Committee.

OBAN.—New post office (£9,650). H. Macdougall, contractor, Oban.

OMAGH (Co. TYRONE).—Contemplated new premises for Ulster Bank, Ltd.

OTLEY.—Proposed new grammar school; T. A. Duncan, chairman of the Governors.

PADSTOW (CORNWALL).—New Primitive Methodist school.

PAULTON (BRISTOL).—Church Institute (£2,000). T. Melhuish, architect, Old Grammar School, Shepton Mallett.

PENDLETON.—New Co-operative premises at Irlams-o'-th'-Height. R. Crompton & Sons, builders, Patricroft, near Manchester.

PENMAENMAWR.—Extensive premises. Sibeon Bros., builders, Holywell.

PETERBOROUGH.—Church Institute; S. Dodson, architect, Peterborough. School at Fletton; H. Leete, architect, Huntingdon. Fire station; F. J. Gill, architect, 236, Rolfe Street, Smethwick, Birmingham.

PLYMOUTH.—Church. T. R. Kitsell, architect, 16, George Street, Plymouth.

PONTLLANFFRAITH (MON.).—J. Bain, architect, Arcade Chambers, High Street, Newport, Mon.

PORTOBELLO.—Four shops at Bath Street, for T. H. Beck.

PORTSEA.—Extension of the Jewish Synagogue. Mr. Cogswell, architect, Prudential Buildings, Landport, Portsmouth.

PORTSMOUTH.—Police station at Milton for the T.C.; borough engineer, Town Hall, Portsmouth. Refuse destructors at Baffin's Marsh and Eastney, for the T.C.; Bramwell & Harris, 11, Great George Street, Westminster, S.W.

POULTON (LANCS.).—House and farm buildings, W. Cardwell; stables, &c., W. Rawcliffe; villa, W. Gornall; additions to Warwick House, Miss Rogerson.

READING.—Rebuilding Higher Grade school. Ravenscroft, Son & Morris, architects, 22, The Forbury, Reading.

REDDITCH.—Important sewerage scheme for the U.D.C. (£15,000). Wilcox and Raikes, engineers.

RAMSBOTTOM.—Billiard room at the Mount, Edenfield, for E. Barlow.

RICHMOND-ON-THAMES.—Rebuilding St. John's House, Clarence Street; Arthur Grove, architect.

RIPLEY (near DERBY).—Sewage works for the U.D.C. (£3,350). G. and F. Tomlinson, contractors, Derby.

ROCHESTER.—Shop and warehouse, High Street, Strood Intra, for W. Paine and Co.; house, King's Avenue, St. Margaret, for J. A. Nash; bungalow, Mount Road, Borstal, St. Margaret, for R. Whyman; houses, York Street, St. Margaret, J. H. Durrant, builder, 282, High Street; bungalow, Mount Road, Borstal, for W. Claridge. Offices, High Street, for the Medway Conservancy Board (£3,999); G. E. Bond, architect, 384, High Street, Rochester; L. Seager, builder, London Road, Sittingbourne.

RUSHDEN.—New factory in Spencer Road, for Sanders & Sanders; extension of factories, for the Co-operative Wholesale Society, C. W. Horrell, and Hyde, Ltd.

RYDE (I.W.).—Renovations and improvements to Primitive Methodist premises.

SAFFRON WALDEN.—Alterations to the hospital; A. Edward, architect, 51, High Street, Saffron Walden. New wing at the grammar school, W. C. Robinson, architect, Audley End.

ST. ANNES (LANCS.).—Semi-detached houses, Riley Avenue, for J. Sutcliffe.

ST. HELENS.—Alterations at the Town Hall; G. J. C. Broom, borough engineer. Six boiler sheds, Napier Street, for J. Ellison, builder, 166, Boundary Road.

SALISBURY.—Alterations and additions to 52, Fisherton Street. F. E. Hale, Building Material Co., Salisbury.

SALTERFORTH (YORKS.).—New School for the West Riding of Yorks C.C. J. Vickers-Edwards, county architect, Wakefield.

SHEFFIELD.—Meersbrook Tannery to be converted into sale shops and workmen's flats; new buildings in connection with the Croft House Settlement extension scheme (£5,000).

SMITHYBRIDGE (LANCS.).—Prospective rebuilding, after fire, of cotton spinning mill at Clegg Hall, for T. Wilson & Sons.

SNODLAND (near MAIDSTONE).—New Post Office, High Street. R. Langridge, builder, Ham Hill, Birling, Kent.

STAVELEY (near KENDAL).—Additions to Abbey Home. Joseph Pattinson, architect, Windermere.

STOCKPORT.—New church for Furness Vale and Newtown.

STOKE-ON-TRENT.—New Catholic Church at Tean.

STRATFORD-ON-AVON.—Houses, St. Gregory's Road. Mr. Goodeve, builder.

SUTTON.—Additions to buildings of Sutton Co-operative Society.

SWANSEA.—Offices, York Street and Little Wind Street, for Pascoe & Co.

TIDWORTH (HANTS.).—Infants' school. Director of Barrack Construction, 80, Pall Mall, London, S.W.

TREFOREST (near PONTYPRIDD).—Chapel Hall, Park Estate, for the Calvinistic Methodist Church. A. O. Evans, Williams & Evans, architects, Pontypridd.

TWICKENHAM.—Eight houses, Denmark Road; G. F. Sharpe, architect, 57-58, Chancery Lane, W.C. New bakehouse, &c., London Road; Howard, Goadby & Marrian, architects, Bank Chambers, London Road, Twickenham.

TYNEMOUTH.—New Y.M.C.A. premises at North Shields (£4,500). J. W. Macdonald, hon. treasurer, 15, Camden Street, North Shields.

WAKEFIELD.—Houses, Cambridge Street and West Street, for Joseph Slack; A. S. Nicholson, architect, City Chambers. Wilhelm Avenue, for Coates & Atkinson; Abraham Hart, architect. Furniture stores, &c., junction of Vicarage Street and Witton Street, for H. P. Pickard; stables, coach house, and store, Eastmoor Road, for Geo. Blakey, Market Street. Additions to Clayton Hospital; C. W. Richardson & Sons, architects.

WALKDEN.—Blocks of houses for J. Cocker, builder, Walkden, and J. Bridge, builder, Walkden.

WALSALL.—Conversion of Bloxwich Music Hall into public hall (£500). Town Clerk, Council House, Walsall.

Rolling Mill, Green Lane, Burchills, for the Talbot Stead Tube Co., Ltd.

Alterations and extensions to works, Bloxwich, for the New Delaville Spelter Co., Ltd.

WALSOKEN (NORFOLK).—Country school. T. M. Kerridge, architect, Old Market, Wisbech.

WATERLOO (near LIVERPOOL).—Three houses, Worthing Street, for Wm. Kay. Conversion of house into shop, 28, Ewart Road, Seaforth, for Hawley & Co.

WATFORD.—Church in the Harwood's Farm district; Watford Deanery Church Extension Society. Manual instruction centre at Victoria Senior Boys' School; U. A. Smith, county surveyor, Hatfield.

WETHERBY.—New post office in the Market Place.

WHALEY BRIDGE.—Sewage scheme for Whaley Bridge, Chapel-en-le-Frith, and Macclesfield District Councils (£20,000).

WHITSTABLE.—Houses, Northwood Road, for Mr. Parker; Tankerton Road, for W. Camburn, builder, 53, Oxford Street; Gordon Road, for Frank Tyars; Tankerton Road, for Mr. Cogger.

WHITWORTH (near ROCHDALE).—New schools in connection with St. Anselm Roman Catholic Church.

WICK.—New Higher Grade School. D. and J. R. McMillan, architects, Crown Street, Aberdeen.

WIDNES.—Probable re-erection (after fire) of business premises, Widnes Road, for Messrs. Pearson, grocers; alterations and additions to premises, for the Runcorn and Widnes Co-operative Society.

WITHNELL (near CHORLEY).—Gas Works extensions. Surveyor, Council Offices, Withnell.

WOKING.—Technical School. Jarvis & Richards, architects, Queen Anne's Gate, S.W.

WOKINGHAM.—Houses, Goodchild Road, for Miss Phillips; Park Avenue, for A. Bunce; Langborough Lane, for A. J. Priest.

WOOLACOMBE (DEVON).—Church. W. D. Caröe, architect, 3, Great College Street, S.W.

YARMOUTH.—Addition to Hospital: Olley & Haward, architects, Queen Street, Yarmouth. Additions to Infirmary; H. Arnott, architect, Gorleston-on-Sea.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Glasgow Students).—Friday, December 18th. At 8 p.m. At the Glasgow Technical College.

Electro-Harmonic Society.—Friday, December 18th. At 8 p.m. At the Holborn Restaurant (King's Hall). Smoking Concert.

Institution of Civil Engineers (Students' meeting).—Friday, December 18th. At 8 p.m. At the Institution of Civil Engineers. Paper on "High-Power Water-Turbines on Moderate Falls," by Mr. R. Wolfenden.

North-East Coast of Engineers and Shipbuilders.—Friday, December 18th. At 7.30 p.m. At the Lit. and Phil. Society, Newcastle-on-Tyne. Discussion on Mr. J. B. Duckitt's paper on the "Electrical Equipment of Cranes," to be resumed.

Association of Engineers-in-Charge.—Saturday, December 19th. At 7.30 p.m. At St. Bride's Institute, London, E.C. Discussion on paper on "Coal," by Mr. W. H. Booth.

Faraday Society.—Monday, December 21st. At 8 p.m. At the Library of the I.E.E. Paper on "The Influence of Cheap Electricity on Electrolytic and Electrothermal Industries," by Mr. E. A. Ashcroft.

Institution of Civil Engineers.—Tuesday, December 22nd. At 8 p.m. Paper on "An Investigation of the Heat Losses in an Electric Power Station," by Mr. F. H. Corson.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued:—

Monday, December 21st.—"A" Company. Infantry drill (recruits), 6 to 7 p.m. Technical drill, 7 to 10 p.m.

Tuesday, December 22nd.—"B" Company. Technical drill, 6 to 8.30 p.m. Infantry drill, 8.45 to 9.45 p.m. Medical inspection for recruits, 6.30 to 7.30 p.m.

The Head-quarters will be closed from December 23rd to January 3rd, both dates inclusive.

The usual drills for the companies will commence on January 4th, 1909.

(Signed) J. H. S. PHILLIPS,
Capt. and Acting Adjutant.

NOTES.

Our December 25th Issue.—The ELECTRICAL REVIEW, which is due to appear on Christmas Day, will be published on Wednesday morning next, December 23rd. Will our friends therefore kindly take note of the following arrangements, so as to avoid disappointment and delay?

All matter for the "Correspondence" pages should reach this office by first post on Monday morning, December 21st. Notes and news matter should be received in the course of the same day, though late news of special interest will be welcomed up to early on the morning of Tuesday, December 22nd.

Our Advertisement Department announces that new copy and alterations to existing displayed advertisements should reach it not later than this (Friday) morning. Official Notices and small prepaid advertisements can be received up to 9.30 a.m. on Tuesday, the 22nd.

The Institution Secretaryship.—The Council of the Institution of Electrical Engineers is inviting applications for the appointment of Secretary to the Institution. Candidates must not be more than 45 years of age, and importance is attached to the following qualifications: administrative experience; tact and business capacity; acquaintance with the profession; knowledge of foreign languages, and technical knowledge.

The London Companies' Electric Supply Bills.—In the House of Commons on Monday there was a lengthy consideration of the London Electric Supply Bill. Mr. Churchill moved a new clause, which was agreed to, providing that from the date when the Council gives notice to purchase the undertaking of a supply company, it shall not be lawful for that company, except with the Board of Trade's consent, to increase its general supply charges. Other amendments related to street-opening powers. Further, on the motion of Mr. Churchill, what he described as the most important amendment of all, and one designed to give a clearer definition of the terms of purchase, was moved. It was to amend Clause 22 so that the undertakings of the several London supply companies within the county provided or constructed under the powers of the Act, should, if purchased by the Council, be paid for upon the terms given in Sec. 2 of the 1888 E.L. Act, subject to certain provisions. It was also agreed that the L.C.C. might pay three-fourths, instead of one-half, of the purchase price of any undertaking in stock. The Bill was read a third time.

The Westminster and Kensington Electric Supply Companies' Bill was considered later, and a clause providing for the protection of the Greenwich Observatory was added to the Bill.

The Posting-up of Tramcar Regulations.—The Liverpool magistrates on Friday had to deal with a test case respecting the first-class tram fares, in which Mr. Alfred Alsop, insurance agent, was summoned in respect of two instances in which he declined to pay more than the ordinary fare on a Dingle car. Defendant raised the objection that the list of fares on the first-class cars was not exhibited so as to be visible to him, as only an outside passenger.

Evidence for the Corporation was called to show that the list of fares could be seen, and that defendant was asked by a conductor to examine the list and so ascertain that the extra penny was being legally charged.

The Bench intimated it was not for them to decide with respect to the correct action of the Corporation relative to the posting of lists of charges outside as well as inside the cars. That point could be raised elsewhere. They, however, decided that the form and position of the list did not absolve defendant from paying the full fare. A fine of 20s. with 5s. 6d. costs, in each case, was inflicted.

The New Patents Act.—The first important case to be considered under the above Act was decided on December 9th, by the Controller of Patents. An application was made for the revocation of a patent for imitation stone slabs, on the ground that the invention, owned by a Belgian firm, was not being worked in this country. It appeared, during the hearing, that the process was in operation in Germany, France and Belgium, and that it was exclusively carried on outside the United Kingdom. The patent was revoked, subject to an appeal to the Courts.

Football.—An inter-departmental match between L.C.C. Tramways Sub-stations F.C. (Southern Section) and Clapham Car Shed, was played on Clapham Common on Thursday, 10th inst. Result: Sub-stations 3, Car Shed 2.

The Syndicate in the German Electrical Industry. The question of the alleged secret syndicate in the German electrical industry, to which reference was made in this Journal a short time ago, has again been raised in connection with a contract for the supply of transforming plant for the chief railway station at Frankfort-on-the-Main. Five firms submitted tenders as follows:—(1) £5,800; (2) £4,900; (3) £6,211; (4) £6,450; and (5) £5,765. It was stated that the first four offers emanated from members of the syndicate, and that the intention was to secure the allotment of the order to the second firm, whilst, on the other hand, it was reported that the syndicate had been dissolved. Both these statements have now been contradicted, although it is added that the tenders were presented in open competition without the syndicate being concerned in the matter.

Tramcar Accident Claims.—At the Newcastle-on-Tyne County Court on the 15th inst., before Judge Greenwell, Joseph Watson claimed £100 from the Newcastle Corporation in respect of injury caused to himself, and damage caused to his cart by a tramcar, in consequence, it was alleged, of the negligent driving of a motorman in the defendants' service. Mr. Rutherford appeared for the plaintiff, and Mr. E. Meynell for the defendants. Mr. Rutherford said the plaintiff was a yeast merchant, and on April 18th was driving a dog-cart from North Shields to Byker. The time was shortly before 12 o'clock midnight. Between Wallsend and Newcastle the plaintiff was proceeding with the right wheel of his trap over the near tramline. He saw the tramcar approaching, and heard the gong sounded, but before he could draw out of the way the car crashed into the cart and threw him into the air. It was a clear night and the lights on the plaintiff's cart were burning, so that the driver of the tramcar ought to have seen it. The plaintiff was laid up for 22 weeks. The plaintiff gave evidence, and in cross-examination denied that he was clear of the tramline and pulled on to the line when the car was close upon him. He had only two drinks after 4 o'clock on his way down. Mr. Meynell, for the defence, said that the motorman was proceeding along the road, and the plaintiff was driving his cart alongside the kerb until the car was about 10 yards from him, when the cart was pulled across the line. The motorman put his brakes on hard, but was unable to pull up, and the car touched the cart.—The motorman gave evidence as to the collision, and said that he believed the plaintiff was under the influence of drink. His Honour, in giving judgment, said no reasonable account had been given why the plaintiff had been on the road at such a time of night. It was very unlikely that anyone would be buying any yeast at that time; and it was more than probable that the plaintiff had had too much to drink. There was no justification for his being on the tramlines at all; not that he had not the right to be there, but, as there was 13 ft. clear at the side, he should not have put the car and the passengers to the inconvenience of having to stop. His Honour accepted the motorman's evidence, and gave judgment for the defendant corporation with costs.

At the Blackburn County Court, on Monday, a jury awarded £100 damages against the Blackburn Corporation to the widow of a man named Speight, of Rishton, who had died from injuries sustained from being knocked down by an electric tramcar. The jury expressed the opinion that a Board of Trade halt notice should be placed at the crossing where the accident occurred, and that no two tramcars should pass the crossing at the same time.

Institution and Lecture Notes.—ROYAL INSTITUTION.—The following are among the lectures announced in the syllabus just issued for the season:—

Friday, February 12th, at 9 o'clock.—Prof. H. A. Wilson, M.A., D.Sc., F.R.S., &c., on "The Electrical Properties of Flame."
Friday, February 19th, at 9 o'clock.—Sir H. Cunynghame, K.C.B., M.A., M.I.E.E., on "Recent Advances in Means of Saving Life in Coal Mines."
Friday, February 26th, at 9 o'clock.—The Earl of Berkeley on "Osmotic Pressures."
Friday, March 12th, at 9 o'clock.—Mr. S. G. Brown, M.I.E.E., on "Modern Submarine Telegraphy."
Friday, April 2nd, at 9 o'clock.—Prof. Sir J. J. Thomson, F.R.S., &c., on "Electrical Striations."
Thursdays, January 21st and 28th, at 3 o'clock. Prof. J. O. Arnold on "Mysteries of Metals."
Saturdays, February 27th, March 6th, 13th, 20th and 27th, and April 3rd at 3 o'clock.—Prof. Sir J. J. Thomson, F.R.S., &c., on "Properties of Matter."

The Gary Plant of the Indiana Steel Co.—A recent issue of our American namesake contains some interesting details of the new steel works of the Indiana Steel Co., 23 miles east of Chicago on Lake Michigan. Eight blast furnaces have been erected up to the present, and all the gas product is utilised either in blowing engines or for operating gas engine-driven electrical plant for supplying power in the works. The initial equipment of the works is 16 blast-furnaces, which are estimated to produce some 45 million cb. ft. of gas per 24 hours; this will be distributed approximately as follows:—30 per cent. for stove heating; 7½ per cent. steam raising; 5 per cent. for auxiliaries, &c.; 12½ per cent., gas-driven blowers; and 45 per cent. for supplying the electric power station. The blowing plant includes 16 engines of 2,500 H.P. each, supplied half and half, by the Westinghouse and Allis-Chalmers Cos., and the electric power station contains 17 horizontal twin-tandem double-acting gas engines, rated at 4,000 H.P. each, and coupled to 15 three-phase 25-cycle 6,600-volt and two 250-volt direct-current generators—the complete units having been supplied by the Allis-Chalmers Co.

In connection with the power station a large storage battery has been installed. The power will be distributed in the works for operating the heavy induction motor-driven rolls, the tilting and feed tables, hot saws, hot and cold pull-ups, hot rolls, transfer tables, straightening and drilling machines, cold saws, elevating and conveying plant, pumps, &c. The rail mill, which is expected to produce 4,000 tons of steel rails daily, is equipped with 12 sets of roll trains operated by G.E.C. alternating current motors of an aggregate capacity of 24,000 H.P., and including several motor units of 6,000 H.P. each, and others of 2,000 H.P. each. For the operation of cranes, tables, and other apparatus in and about the rail mill, requiring direct current, two 500-KW. motor-generators have been supplied by the G.E. Co.

The billet mill contains further large motors, two of 2,000 H.P. and three of 6,000 H.P. each, for driving individual mills. All the machinery is electrically driven by General Electric, Crocker-Wheeler and Westinghouse motors; the motor controllers are largely of Cutler-Hammer type, and the main power station switchboard was supplied by the Western Electric Co.

Supervision of Electrical Installations in Germany.—It is now several months since reference was made to a scheme prepared at the instance of the Prussian Minister of Commerce, based upon the law of July 8th, 1905, in regard to the examination of installations needing supervision, for the introduction of police regulations regarding the establishment, working and superintendence of electrical generating stations and installations. The project encountered considerable opposition in industrial circles, and after a conference which took place between interested parties and representatives of the Ministry of Commerce, the Union of Electrical Engineers convened a meeting of delegates of local authorities and industrial corporations last May, when a resolution was adopted declaring it to be most desirable that the issue of police regulations should be postponed for several years. At the same time the Government scheme was discussed, and a committee of 10 was appointed to work out an alternative project. The task has now been completed, having regard to the consideration of certain principal doubts which were entertained in interested circles against the Government proposal. It is pointed out in the first place that the accidents which have hitherto been caused by electricity are by no means greater than with other forms of energy, and that the assumption of a partial attitude towards electrical engineering would consequently not be justified. If, nevertheless, the State authorities take measures for the purpose of the more strict supervision of electrical installations, the latter should be limited to cases in which public interest exists. As the regulations of the Union of Electrical Engineers are generally observed in practice, it is contended that police supervision would find nothing to improve. The expenses to be borne by the owners of electrical installations for superintendence, as well as the incidental and inevitable inconveniences of further supervising departments, would be a hindrance to the extension of electrical working, which is so urgently desired. All would suffer from this obstacle, especially small industries for which electricity has become of vital importance. The proof that an existing installation is in a condition corresponding with the regulations could not, in most cases, be produced without destroying material parts of the installation, so that police regulation, as a rule, would remain unavailing. The frequently drawn comparison with the supervision of steam boilers is not sound, as sufficient conclusions as to the condition of the boiler could be drawn from the constructional drawings and the pressure test in association with local inspection, but this would be impossible with electrical installations. The dangers of a steam boiler could also not be placed upon a parallel with those of electrical installations. The alternative scheme prepared by the Committee has been published and submitted for the consideration of the Minister of Commerce.

Commercial Illuminating Engineering in Boston, U.S.A.—A departure from the beaten paths of public lighting service corporations was made on September 1st, by the Edison Electric Illuminating Co., of Boston. The company on that date opened a Department of Commercial Illuminating Engineering, which will utilise the expert services of Louis Bell, Ph.D., at the present time president of the Illuminating Engineering Society of America, for the help of every Edison customer. The company says it will give its customers the very latest and best word on the lighting subject. Because of the ease with which electric light wires can be run from one place to another and the convenience of this form of lighting, many customers have contented themselves with having lights everywhere they thought they were needed. This has been a wasteful way, and caused users of electric light unnecessary expense. Edison officials say that these conditions have been corrected in many instances, but there must be others that the company's agents have not found, or that customers themselves have not brought to notice. No attempt will be made to get customers to increase their bills; in fact, the plan discourages any such thing. General Supt. W. H. Atkins recently said:—

"We have brought the manufacture and delivery of electric current to the highest point of perfect service. . . . . More electricity is used *per capita* by the people of Boston than in any other city in the world. Now we propose to go further and give our customers the benefit of professional skill, so that they can get more illumination (useful light) for the same amount of money they are now paying us, or the same amount of good light for less money. Either way the customers choose will be to their advantage. In many business places and homes, plenty of light is used now, but it doesn't go in the right direction. One of our experts can see quickly what the trouble is, and by changing a lamp here and there, or by introducing different reflectors, the problem will be solved. We want our customers to know that this work will be in their interest. All they have to do is to ask us to send an expert to look over things with them. It will cost them nothing for advice; in fact, it will either save them money on the same amount of light or give them more light for the same money. . . . . That a pleased customer is our best advertisement is just as true of the electric lighting company as of the butcher—perhaps more so."—*Electrical Record*, U.S.A.

Electric Shock Fatality.—A Dunfermline miner was killed last Saturday in the Aitken Pit, at Kelty, of the Fife Coal Co., by coming into contact with a "live" cable. He was employed at the lifting of a pavement in one of the docks, when part of the side of the road collapsed, causing the cable to fall to the pavement. He was in the act of replacing it when it came into contact with his chest, and he was instantaneously killed. Within the past year or two several such fatalities have occurred.

The Total Heat of Saturated Steam.—This month has seen the presentation to the American Society of Mechanical Engineers of a paper on the total heat of saturated steam, for which we think justification exists. Regnault's accepted figures have served well our day and generation, but better means of experiment are now available, and the author of this paper, Dr. Harvey N. Davis, considers that there are results available sufficient to warrant a recalculation of the values. Regnault's formula, now 61 years old, is—

$$H = 1{,}091{\cdot}7 + 0{\cdot}305\,(t - 32) = \text{B.TH.U.}$$

Though numerous retests have been made below 212° F., nothing has been done till lately above that temperature. But certain observations recently made for other purposes seem to show that a better set of values above 212° should now be taken, and a new formula ranging up to 400° F. is proposed. If this be correct, then Regnault's figures for H are too high by 1·7 per cent. at 32°, and too low by 0·5 per cent. at 275°, but again too high at 380°, and going rapidly worse with rise of temperature. Mr. Davis discusses the experiments of Grindley in England in 1900; of Griessmann in Germany in 1904; and of Peake in England in 1905. Close agreement exists between the results of these three sets of throttling experiments. The curves obtained from the points of each experimenter were plotted on thin rice paper, and curves determined by sliding one over another. To be brief, a new formula for H was determined as—

$$H = H_{212} + 0{\cdot}3745\,(t - 212) - 0{\cdot}000550\,(t - 212)^2;$$

H_{212} being the total heat of steam at 212° F. as may ultimately be decided to be correct. The value for H_{212} is assumed to be 1,150·3 B.TH.U., being the mean of the values of Henning and Joly. This value is then, for the present, to be substituted for H_{212}. Compared with Peabody's table, the total heat at 32° is 1,073·4 in place of 1,091·7. At 212° it becomes 1,150·3 in place of 1,146·6, and at 401° it becomes 1,201·5 in place of 1,204·2. The specific volumes differ by correspondingly small amounts. Thus the differences are really very trifling.

The values of Knoblauch's tests differ very little from the formula results, only crossing the calculated curve at nearly 450°. Regnault's figures give a curve which crosses at about 150° and again at nearly 340°. From the new values of H_1, of the heat r of vaporisation, and of the change of volume u during vaporisation, the value of c_p, or specific heat at constant pressure, may be calculated. The worst error in Regnault's figures between 212° and 400° is 6 B TH.U. at 275° F.

The author promises a new table of steam-heat values, &c., by himself and Prof. Marks. If, as seems probable, Regnault's figures have been wrong, the error has hardly been commercially serious—not worse than errors in indicators and in thermometers, in men who have to read instruments, and in a score of ways that are familiar to the experienced tester. Nothing decisive seems to be yet fixed upon in regard to the specific heat of saturated steam. In this very volume before us is another paper giving Knoblauch's values for c_p quite different from the same authority's figures in the special paper under review.

Electrical Production of Steel.—The Société Anonyme Electrométallurgique, of Neuchatel, which works the processes invented by M. Paul Girod, recently decided to increase the ordinary share capital from £200,000 to £400,000 for the purpose of extending the works for the electrical production of steel. Two works are owned by the company in Switzerland and one in France, and the additional capital is intended to develop the water-power plants in connection with the steel process. According to a statement issued by the company, the process has been in practical operation at Ugine for the past three years, and the steel made has been supplied to French and other consumers. The system is said to have been adopted by the Forges de la Loire et du Midi; Marrel Frères, of Rive de Gier; the John Cockerill Co., of Seraing; Schoeller & Co., of Ternitz; Oehler & Co., of Aarau; and A. Stotz, of Stuttgart Kornwestheim. The first Girod steel patents date back to 1904, and have been granted in most countries. The company, which was formed in 1903, and has largely been concerned with the manufacture of metal alloys, paid a dividend of 7½ per cent. in 1907 on an average share capital of £80,000, which has since been increased to £200,000 and to £400,000, as already mentioned.

The Manchester New Royal Infirmary.—With reference to our description of the above installation in last week's issue, we are informed by Messrs. Ward & Goldstone that they supplied the special wood casing for the work (as agents of Messrs. Creighton, Ltd); they also supplied the electric light flexible, an enormous quantity of Indispenso connectors for wiring the various electroliers, and the lead-covered cable for all the private telephones and electric bells.

Messrs. J. H. Tucker & Co. also state that they supplied the whole of the 5-amp, 10-amp., and two-way tumbler switches, iron-cased watertight switches, wall sockets and plugs, used in the installation.

Appointment Vacant.—Borough electrical and tramways engineer for Rawtenstall (£200).

500!—The Swansea Harbour Trust has received 500 applications for the post of electrical engineer.

Fixation of Nitrogen.—The unfavourable position of the aluminium trade is reported to have induced the Neuhausen Aluminium Industry Co. to decide upon the utilisation of a portion of the additional power which will become available at the new works for the manufacture of nitric acid and nitrates derived from atmospheric nitrogen. With this object in view, the company has entered into an agreement with the owners of the patents of the engineer Moscicki at Freiburg, Switzerland, whose experiments are said to have led to a very favourable conclusion after trials extending over many years, whereby the company has become possessor of, the patents for Switzerland and Austria. A community of interests has also been concluded between the Aluminium Co. and the patent owners with regard to manufacturing under, or the sale of, the patents in other countries. The work of establishing plant for the production of nitric acid and nitrates has already been commenced at the new works at Chippis, Valais, and a portion of the installation is to be set in operation next year.

Gas Exhibit at Shepherd's Bush next Year.—We print the following paragraph from last Friday's *Gas World* for the consideration of the London electricity supply authorities and others who may be interested:—"It may be mentioned here that the gas exhibit will, in all probability, be continued next year under the auspices of the London gas companies, when the Exhibition at Shepherd's Bush opens again under a new designation."

Called to the Bar.—The Windsor Magistrates at their last sitting transferred the licence of the Two Brewers public house in that town to Mr. Francis O'Hara, who stated that he was an electrical engineer by profession, and at the same court the licence of the Stag and Hounds, Spital, was transferred to Mr. William Victor Cannon, also an electrical engineer.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. G. O. Milburn has resigned his position with the Sheffield Corporation tramways, to take up the position of engineer-in-charge with the Coatbridge and Airdrie Electric Supply Co.

Tramway Officials.—The salary of Mr. J. S. D. Moffett (tramway manager at Rochdale) has been increased from £300 to £350 per annum, with further increases of £25 in each of the two following years.

General.—It is announced that the Nobel Prize Committees have decided to award this year's prize for chemistry to Prof. Ernest Rutherford, of Manchester University; that for physics being awarded to Prof. Gabriel Lippmann, of Paris.

Mr. G. Myers has been appointed as wireman and electrician to the L.C.C. on the Blackwall Tunnel at 43s. per week, in place of Mr. G. A. Minshall, transferred to Rotherhithe Tunnel.

The *Times* states that Prof. Sir James Dewar has been unanimously elected an honorary member of the German Chemical Society.

Mr. W. H. N. James, lecturer in engineering at the Municipal School of Technology, Manchester, has just been appointed lecturer in electrical engineering at the Bradford Technical College, at a salary of £170 per annum for day teaching, with allowances according to scale for evening classes.

On Saturday, the 12th inst., a smoking concert was held at the Alexandra Hotel, Stafford, under the chairmanship of Mr. F. C. Schiller, in order to say farewell to Mr. Percy N. Rand, who has been connected with the Siemens firms for over 15 years. The chairman presented a solid silver tea service, together with an address signed by 67 subscribers, and Mr. Rand suitably responded. Mr. Rand is severing his connection with Messrs. Siemens Bros. Dynamo Works, Ltd., in order to take up an important post with the Westinghouse Co., where he will devote his time principally to switchboard work.

Obituary.—We regret to learn of the death of Mr. L. L. Hartvigson, which occurred on 27th ult., the cause being heart disease. Mr. Hartvigson, who was born in 1849, entered the Great Northern Telegraph Co. more than 35 years ago, starting his career at the very station where he ended his days. Having served at various of the company's stations both in the Far East and in Europe, he was appointed in London in 1883, where for many years he filled the important post as the company's engineer in England. In 1885 he was sent to St. Petersburg to demonstrate the utility of the Wheatstone system, the trials being so successful that the Russian Telegraph Administration shortly after introduced the system on the main circuits between St. Petersburg and Wladiwostock. During his appointment in London he controlled the manufacture of several thousand miles of submarine cable at all the leading cable works. In 1903 he was appointed superintendent at Newcastle.

The death occurred on December 8th of Mr. John Thos. Harris, J.P., for many years managing director of Messrs. Bullers, Ltd., manufacturers of telegraph insulators, &c., Hanley. He was 65 years of age.

The death took place on December 8th, in his 68th year, of Mr. Thomas Flamwell, of the firm of T. Flamwell & Son, electrical engineers, Church Walk, Worksop, which business he established in 1868.

NEW COMPANIES REGISTERED.

Caergwrle and District Electricity Supply Co., Ltd. (100,390).—This company was registered on November 25th, with a capital of £350 in £1 shares, to carry on at Caergwrle and elsewhere the business of an electric light and power company in all its branches. The subscribers (with one share each) are:—R. F. Allen, Mountain View, Hope, Flintshire, gentleman: H. H. Hughes, Ty-Cerig, Caergwrle, gentleman. Private company. The number of directors is not to be less than five or more than 10; the subscribers are to appoint the first; qualification, £25. Registered by Worthington Evans, Dawnay & Co., 27, Nicholas Lane, E.C.

British Tungsten Lamp Co., Ltd. (100,468).—This company was registered on December 1st, with a capital of £13,000 in £1 shares, to adopt an agreement with the Metallfadenlampenwerk, Berlin, G.m.b.H., and the Syndicate Lamp Co., Ltd., for the purchase of the British and Colonial rights in the metal-filament lamp which belong to the said German company, and in which the Syndicate Lamp Co., Ltd., have an interest. The subscribers (with one share each) are:—L. Higginbottom, 14, Broomfield Road, Heaton Moor, engineer; R. Hilditch, 16, John Dalton Street, Manchester, solicitor; T. Dicken Jones, Eastwood, Huyton, manager; T. Walton, 36, Spring Gardens, Manchester, chartered accountant; T. Johnson, Latrigg, Hulmes Road, Clayton Bridge, architect; E. W. Barnaby, Cliff Cottage, Wilmslow, clerk; W. D. Cash, 21, Marlborough Avenue, Clarendon Road, Whalley Range, Manchester, clerk. Minimum cash subscription 90 per cent. of the shares offered to the public. The number of directors is not to be less than two or more than five: the first are A. Wenck, of Berlin, and F. C. Becker, of Purley, Surrey (representing the holders of the German shares), and L. Higginbottom, H. S. Morrison, of 52, Albermarle Road, Beckenham, and T. Johnson (representing the holders of the remaining shares); qualification, £100; remuneration (except managing directors) £25 each per annum. For one year from the date of incorporation, every 10 German shares confer one vote; afterwards each such share shall confer one vote. Each other share confers one vote at any time. Registered office, Canada Chambers, 36, Spring Gardens, Manchester.

Bruce Peebles & Co., Ltd. (6,962).—This company was registered in Edinburgh, on December 5th, with a capital of £250,000 in £1 shares, to acquire the business carried on by Bruce Peebles & Co., Ltd. (in liquidation), at East Pilton, Edinburgh, and to carry on in the United Kingdom, or elsewhere, the business of electricians, mechanical engineers, suppliers of electricity for the purposes of light, heat or motive power, brassfounders, gas-meter manufacturers, tube makers, metal workers, wire drawers, ropemakers, garage, store and warehouse keepers, &c. The subscribers (with one share each) are:—J. Shields, 141, George Street, Edinburgh, chartered accountant; J. Watt, 28, Charlotte Square, Edinburgh, W.S.; A. Blair, 28, Charlotte Square, Edinburgh, W.S.; A. W. Watson, 28, Charlotte Square, Edinburgh, W.S.; W. Blair, 28, Charlotte Square, Edinburgh, W.S.; D. Porter, 28, Charlotte Square, solicitor; J. Gowans, 83, Charlotte Square, Edinburgh, chartered accountant. The number of directors is not to be less than three or more than seven; the first are C. H. McEuen, M. B. Mountain, A. Mackenzie, F. E. Andrews, J. Shields and A. W. Tait; qualification, 250 shares; remuneration, £100 each per annum (chairman, £200). Registered office, East Pilton, Edinburgh.

Newall's Insulation Co., Ltd. (100,451).—This company was registered on November 28th, with a capital of £60,000 in £1 shares, to manufacture, deal in, erect and apply materials and appliances for affording insulation or protection from or for heat, cold, light, electricity, sound, blows, vibration, air, water, fluids, gases, emanations or rays, to manufacture, deal in and apply cork, magnesia, asbestos, silicate of cotton, lime refuse, fossil meal, charcoal, flax and other substances, to manufacture and deal in chemical products and substances, and to acquire or subscribe for shares, debentures or liabilities of Magnesia Coverings, Ltd., and the Washington Chemical Co., Ltd., and to adopt agreements (*a*) with Magnesia Coverings, Ltd., and another, and (*b*) and (*c*) with the Washington Chemical Co., Ltd. The subscribers (with 500 shares each) are:—F. S. Newall, Castle Hill, Wylam, chemical manufacturer; G. F. Newall, Castle Hill, Wylam, engineer. Private company. The number of directors is not to be more than five; F. S. Newall is the first qualification, £500; remuneration, £100 each per annum.

Salisbury Publications Co., Ltd. (100,481).—This company was registered on December 1st, with a capital of £1,000 in £1 shares, to acquire the paper known as *Biggs & Sons' Contractors' Record and Municipal Engineering*, and to carry on the business of publishers, printers, &c. The subscribers (with one share each) are:—Miss B. Biggs, Glebe Lodge, Champion Hill, S.E.; C. H. Biggs, Coombe House, Stanmore Road, Richmond, Surrey, journalist; E. J. Biggs, Glebe Lodge, Champion Hill, S.E., journalist; A. Anson, 18, Eastcombe Avenue, Charlton, Kent, bank clerk; R. W. Weekes, 65, Hayes Road, Bromley, Kent, consulting electrical engineer. Private company; the number of directors is not to be less than two or more than five; the first are A. Anson and R. W. Weekes; qualification, 10 shares. Registered office, 139-140, Salisbury Court, Fleet Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Adams Manufacturing Co., Ltd. (84,224).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Deed of covenant and charge dated May 27th, 1903, to secure £2,000. A charge dated November 2nd, 1908, to secure £700 (supplemental to an indenture dated December 19th, 1904) charged on certain hereditaments in Bedford, has been registered. Holders: M. E. Stephens, 11, Mount Street, Berkeley Square, W.; and F. S. Pelissier, 63, Berwick Street, London.

Associated Battery Co., Ltd. (London) (94,179).—Particulars of £2,000 debentures created by resolution of February 26th, 1908, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Nalder Bros. & Thompson, Ltd. (62,214).—This company's annual return, made up to November 12th, has been filed. 8,256 preference and 11,125 ordinary shares have been taken up out of a nominal capital of £22,500 in 10,000 preference and 12,500 ordinary shares of £1 each. £1 per share has been called up on 8,256 preference and 1,125 ordinary shares, resulting in the receipt of £9,381; 10,000 ordinary shares are considered as fully paid. Mortgages and charges: Nil.

Davis Electrical Co., Ltd. (Cambridge) (99,740).—Particulars of £2,000 debentures, created by resolution of October 12th, 1908, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £1,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Mardy Electric Light Co., Ltd. (Ferndale), (52,361).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Mortgage dated 1899, securing £650.

Buenos Ayres Grand National Tramways Co., Ltd. (28,374).—Trust deed dated October 29th, 1908, to secure £200,000 conversion debenture stock (supplemental to trust deeds dated February 16th, 1900, December 9th, 1904, and April 6th, 1906), has been registered, securing £700,000 similar stock, making a total of £900,000. Property charged: A certain concession, lands, property, undertaking and rights. Trustees: Trustees, Executors, and Securities Insurance Corporation, Ltd., Winchester House, E.C.

Frederick Braby & Co., Ltd. (2,537C).—This company's annual return was filed on October 6th, when 20,000 ordinary and 2,500 preference shares had been taken up out of a nominal capital of £250,000 in 22,500 ordinary and 2,500 preference shares of £10 each. £9 per share has been called up on 16,750 ordinary, £5 on 4,250 ordinary and £10 per share on 2,500 preference shares, resulting in the receipt of £192,000, including £20 paid on five forfeited shares. £13,000 (£4 per share) is considered as paid on 3,250. Mortgages and charges: £55,000.

Lancashire Dynamo and Motor Co., Ltd. (61,447).—Particulars of £75,000 debentures, created by resolution of March 14th and June 24th, 1907, and secured by trust deeds of even dates, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £600. Property charged: Land in Trafford Park, Stretford, with premises thereon and machinery therein, and the company's undertaking and other assets, present and future, except uncalled capital. Trustees: E. F. Sheppard, 55, King Street, Manchester; and A. Tongue, 86, King Street, Manchester.

British Prometheus Co., Ltd. (74,889).—Particulars of £3,500 debentures, created by resolution of October 20th, 1908, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £550. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Harper Electric Piano, Ltd. (87,135).—Issue on November 4th of £500 debentures, part of a series of which particulars have already been filed. (Amount now issued, £1,900.)

Richard Pape, Ltd. (Electrical Engineers, London) (97,901).—Particulars of £1,000 debentures created by resolution of September 16th, 1908, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £600. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Veritys, Ltd. (49,784).—A memorandum of satisfaction in full of debentures dated January 9th, 1906, securing £40,000, has been filed. Particulars of £60,000 debentures created by resolution of October 27th, and secured by a trust deed dated October 31st, 1908, have also been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the whole amount being now issued. The above-mentioned trust deed has also been registered. Property charged: Manufactory, warehouse and premises at Aston known as the Plume Works, works and premises at Plume Street known as the Victoria Works, wharf and other buildings in Plume Street aforesaid; and the company's other assets, present and future, including uncalled capital. Trustees: Trustees, Executors and Securities Insurance Corporation, Ltd., Winchester House, Old Broad Street, E.C.

British L. M. Ericsson Manufacturing Co., Ltd. (76,061).—A mortgage dated November 19th, 1908, in support of an issue of £70,000 debentures from time to time outstanding, has been registered. Property charged: Certain lands, hereditaments and premises in Beeston, Notts. Holders: National Telephone Co., Ltd., Telephone House, Victoria Embankment, E.C. Particulars of £70,000 debentures created by resolution of even date have also been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £57,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Anchor Cable Co., Ltd. (69,073).—A trust deed dated November 16th, 1908, to secure £60,000 debenture stock has been registered. Property charged: Land with premises thereon at Pennington, Lancs., and the company's undertaking and property, present and future, including uncalled capital. Trustees: Sir James T. Ritchie, Bart., 6, Lime Street, E.C.; and Sir James F. Flannery, Bart., 9, Fenchurch Street, E.C.

North Staffordshire Tramways Co., Ltd. (12,663).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Trust deed dated 1896, securing £93,300 first mortgage debentures; and second mortgage debentures dated 1898, securing £30,100.

Glamorgan Tram and Constructional Works, Ltd. (100,209).—Two debentures (1) dated November 17th and (2) dated November 18th, 1908, to secure £230 each, charged on the company's undertaking and property, present and future, including uncalled capital, have been registered. Holders: J. H. Hallett, Radyr Chain, Llandaff; and J. Thomas, 7, Malefant Street, Cardiff (Trustees of the South Wales Equitable Money Society).

Ernest Scott & Mountain, Ltd. (32,760).—This company's annual return was filed on October 24th, when 97,790 ordinary and 29,800 preferred ordinary shares had been taken up out of a nominal capital of £150,000 in £1 shares (50,000 preferred ordinary). £1 per share has been called up on 75,790 ordinary and 29,800 preferred ordinary shares, resulting in the receipt of £105,590. 22,000 shares are considered as fully paid. Mortgages and charges: £55,700.

Electrolytic Alkali Co., Ltd. (Middlewich) (64,360).—Particulars of £50,000 first mortgage debentures created by resolution of July 9th, 1904, and secured by a trust deed of even date have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £500. Property charged: The company's undertaking and property, including uncalled capital. Trustees: Liverpool Mortgage Insurance Co., Ltd., 6, Castle Street, Liverpool.

Electric Law Press, Ltd. (London) (72,435).—Particulars of £1,000 debentures created by resolution of November 9th, 1908, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £800. Property charged: The company's undertaking and property, present and future, including uncalled capital (if any). No trustees.

New Rottingdean Electricity Co., Ltd. (60,713).—Particulars of £2,000 debentures created by resolution of June 10th, 1908, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Coatbridge and Airdrie Electric Supply Co., Ltd. (89,178).—A further charge dated November 26th, 1908, to secure £2,500, charged on the company's undertaking and property, present and future, including uncalled capital and the Coatbridge and Airdrie undertakings, has been registered. Holders: County of London Electric Supply Co., Ltd., Moorgate Street, E.C.

Chloride Electrical Storage Co., Ltd. (35,389).—This company's annual return, made up to August 27th, was filed on October 14th. 62,000 preference and 43,168 ordinary shares have been taken up out of a nominal capital of £135,250 in 62,000 preference, 43,168 ordinary and 30,082 unclassified shares of £1 each. £1 per share has been called up on 48,750 preference and 16,250 ordinary shares, resulting in the receipt of £65,000. £40,168 is considered as paid on 13,250 preference and 26,918 ordinary. Mortgages and charges: Nil.

CITY NOTES.

Adelaide Electric Supply Co., Ltd.

The directors' report for the year ended August 31st, 1908, states that with the sanction of the holders of the preference and ordinary shares, a further 6,000 preference shares of £5 each were issued in April and May last, the whole of which were again applied for by and allotted to the public in Adelaide. The cost of the issue was £106. The profit and loss account shows a credit balance for the year of £12,962. After payment of the dividend on the preference shares for the half-year ended February 28th, 1908, writing £606 off suspense account (consisting of the cost of the various issues of preference shares), and placing a sum of £1,000 to depreciation account, there remains, including the amount carried forward from the previous year, an available balance of £9,330, which the directors recommend should be applied as follows:—To dividend on 27,000 6 per cent. preference shares for the half-year ended August 31st, 1908, paid September 1st, 1908, £3,692, to dividend at the rate of 3½ per cent. on 26,065 ordinary shares for the year ended August 31st, 1908, £4,559, carrying forward £879. During the year, a sum of £40,685 was expended on capital account in the provision of additional land, buildings, plant and mains. The policy of extending the company's mains into the residential districts surrounding the City of Adelaide, is bearing good fruit; and applications for light and power are coming in satisfactorily. To meet this demand an issue of further capital will in due course become necessary. The additional generating plant necessitated by the company's contract for the supply of power to the Adelaide Municipal Tramways Trust, has been installed, and it is expected that the supply will be commenced at an early date. The following table shows the progress made by the company during the past five years:—

Date.	Lighting in 8-c.p. lamps.	Motors in rated H.P.	Total equiv. connections expressed in 8-c.p. lamps.	Total units sold.
At August, 1904 ..	33,860	677 H.P.	55,551	729,821
,, 1905 ..	39,690	935 H.P.	69,674	918,902
,, 1906 ..	45,480	1,168 H.P.	82,586	1,151,120
,, 1907 ..	56,964	1,481 H.P.	102,756	1,384,178
,, 1908 ..	71,188	1,887 H.P.	129,222	1,666,974

Mr. R. Percy Sellon retires from the board of directors this year and being eligible, offers himself for re-election.

Cordoba Light, Power and Traction Co., Ltd.

Sir J. Irving Courtenay presided over the statutory meeting of the above company at the offices, 62, London Wall, E.C., on Wednesday last week, when the following report was submitted:—

"The company was registered on September 24th, 1908, with a nominal capital of £500,000 in shares of £1 each. The total number of shares allotted is 38,607, of which 1,007 are payable wholly in cash. Of these 504 are now fully paid up, and 503 are paid up to the extent of 1s. per share. 37,600 shares have been issued fully paid as consideration for 1,880 shares of common stock of $100 each in the Cordoba Light and Power Co., of Maine, U.S.A. An issue of £200,000 of 5 per cent. debenture stock has been made, and the application money in respect of the same, viz., £20,000, has been received, while a further £80,309 has been received, being instalments on debenture stock paid in advance under discount."

The Chairman formally moved the adoption of the report, and this was carried without comment.

Underground Electric Railways Co. of London, Ltd.

The directors' report to September 30th, 1908, says that since the date of the last report the scheme for the conversion of the profit-sharing secured notes and for raising further money by means of prior lien bonds, which was duly sanctioned by the Court, has been carried into effect, and the voluntary liquidation which was necessary to carry the scheme under the Joint Stock Companies' Arrangement Act, 1870, was closed under order of Court on July 21st, 1908. Since the date of the balance-sheet the loan of £183,175 to the Metropolitan District Railway Co. has been repaid, and the sum of £64,999 appearing in the balance-sheet has been paid to the trustees of the power house depreciation fund. Half-yearly accounts will, in future, be submitted to the shareholders, made up to June 30th and December 31st in each year. It is proposed to hold half-yearly meetings, and at the meeting to be held next February there will be submitted a balance-sheet made up to the 31st inst., with a revenue account of the company from the close of the liquidation to the end of the year. The meeting to be held on 21st inst. has only been convened in order to comply with the provisions of the Companies' Acts, which, in effect, require a company to hold one ordinary general meeting in each year. The business to be transacted will therefore be of a purely formal nature.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

The fifty-fourth ordinary general meeting of the shareholders of this company was held on the 9th inst. at the offices, 106, Cannon Street, Major Leonard Darwin presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, December 11th, page 1021), after referring with regret to the loss the company had sustained in the death of the Hon. H. Marsham who had been a director for 21 years and the chairman of the company for seven years, said that as regarded the trading operations during the past year, he thought he might congratulate the shareholders on the fact that the board were able to recommend the payment of the usual dividend. During the past year they had been subjected in their trading to ups and downs and uncertainties. The general turnover had considerably increased, although certain lines had been considerably below the average. Their French works had been unfortunate in the sale of some of its special lines; this had been, to a great extent, due to a staunch determination on their part to maintain the quality of their productions while being forced to reduce their selling prices, although not quite to the same extent as some of their competitors. In the opinion of the board this was a passing situation, and this opinion was supported by the fact that similar circumstances had not occurred for a period of years. The general electrical trade had not been at the standard one could wish. For the information of the shareholders, he might mention that they had 12 branches in the United Kingdom and nine abroad in addition to their warehouse at Paris; their works at Silvertown and at Persan in France depended very largely on these for the marketing of their productions. Bad trade in South Africa, in Australia, India, and South America would adversely affect their general trading. The possession of foreign branches, however, often assisted in counteracting the effects of bad trading at home. Amongst their special lines of manufacture he would like to refer to the Palmer tire which at present showed signs of considerable development, and the board felt that their investment of a large amount of money in this business was now beginning to bear fruit. It was flattering to them as manufacturers that one of the largest producers of motor tires should have adopted, and was now advertising, the merits of the form of tread that the Palmer Tire Co. had been using for the last few years. The Palmer cord motor tire had done some excellent work in trials on the Brooklands track and elsewhere, and would appear to be especially well suited for use on the larger types of motor car.

Mr. C. H. Moore seconded the motion.

The Chairman, in reply to questions, said that with regard to making up the dividend by utilising the carry-forward, the board had always been pressed by the shareholders to equalise the dividends, and that was the policy of the directors. As to the impossibility of shareholders being able to obtain information regarding the affairs of the Palmer Tire Co., in which they were largely interested, he would point out that if they allowed one shareholder to see the accounts, they might have rivals in business taking up the company's shares simply to obtain inside information.

The report was adopted.

Provincial Tramways Co., Ltd. — The directors' report for the financial year ended September 30th, 1908, states that the net revenue received from the local companies was £33,083, against £38,048 last year. The directors recommend a dividend upon the ordinary shares of 4s. per share, making, with 3s. per share paid in June last, the sum of 7s. per share, free of income-tax, for the year. The dividend on the ordinary shares will absorb £4,982, and leave a balance of £3,060 to be carried forward. In common with other tramway concerns, traffic receipts have been reduced by general depression in trade and bad weather during the best months of the year. This has caused a decrease in the net revenue of the local companies. The £175,000 of 5 per cent. first debenture stock was issued in due course, and has been fully subscribed and paid up.

Blackpool, St. Annes and Lytham Tramways Co. —The directors' report that adverse weather and bad trade caused a shrinkage in the traffic receipts as compared with the two previous years, but the net receipts on the company's own lines only show a decrease of £370. The traffic receipts were £27,290, of which £4,917 was payable to the Blackpool Corporation, making the net total £22,372, while other receipts amounting to £779 made a total of £23,152. The balance to the credit of profit and loss account is £5,479.

Costa Rica Electric Light and Traction Co., Ltd. —For the year ended June 30th, 1908, the net earnings of this company were £14,402, as against £14,303 in the previous year. After payment of debenture interest and administrative expenses the surplus profit is £4,490, as against £3,961 last year. This profit will be applied to the sinking fund and the reduction of discount on debenture issue account.

Shawinigan Water and Power Co.—A dividend of 1 per cent. for the quarter ending 31st inst. is announced.

Great Northern Telegraph Co.—An interim dividend of 5s. per share, less income-tax, has been declared.

Prospectuses.—*British Columbia Electric Railway Co., Ltd.*—Subscriptions have been invited this week for £500,000 4½ per cent. perpetual consolidated debenture stock at 99. The issued capital is £1,300,000. The present issue is required for the general purposes of the company to meet business extensions, and more particularly in connection with the further increase of the capacity of the hydraulic electric plant at Lake Buntzen and with the construction and equipment of the Westminster Chilliwack line, 63 miles in length, and of other railways radiating from and supplementing the company's existing system, and also in connection with the Sumas Development Co. dyking scheme referred to in the last annual report. The list was to close on Wednesday.

The Portuguese Wolfram Syndicate, Ltd.—There have this week been offered for subscription 15,000 shares of £1 each.

Bambrakelly (Ceylon) Tea and Rubber Co., Ltd.—This company has been offering an issue of 70,000 shares of £1 each for subscription. Some 200,691 rubber trees were planted on the estates between 1902 and 1907.

Gateshead and District Tramways Co.—Parr's Bank, Ltd., is inviting subscriptions until to-morrow for 10,000 shares of £10 each, at £8 15s. per share. The shares are not a new issue, and they are not offered by the company, but on behalf of the owners, who acquired them on or before the electrification of the undertaking in 1901.

American Westinghouse Co.—The New York *Electrical Review and Western Electrician* reports that the modified reorganisation plan of the Readjustment Committee of the Westinghouse Electric and Manufacturing Co., which has been under consideration for several months, has been declared operative, and apparently all that remains before the discharge of the receivers is the carrying out of the formalities connected with the issuing of the new stock provided for, and, of course, other details which, now that the fundamentals are ready for promulgation, and inauguration, will be incidental to the course of reconstruction. The stockholders were recently to meet in Pittsburg to elect new directors and ratify the various measures necessary to the completion of the reorganisation plan. The merchandise creditors and the bankers who have been co-operating for the purpose of reorganisation will have a powerful voice in the affairs of the company, and with this end in view the directorate will be increased from 12 to 16, divided into four classes, serving from one to four years each. "Four factors have combined to win success for the reorganisation plan, and this success has been won against great odds. These factors have been the loyalty of stockholders in subscribing for $6,000,000 worth of stock at par when it was selling at hardly half that price in the open market; the liberal co-operation of merchandise creditors in agreeing to take $4,000,000 of stock at par in settlement of that amount of claims held against the company; the participation of bankers holding $7,900,000 short-time notes of the company in coming to the front with 85 per cent. of the total amount and taking securities in payment of their obligations. To these factors must be added that which has been most important and inspiring—the personal enthusiasm and optimism of George Westinghouse, president of the company."

Aluminium Corporation, Ltd.—Sir James Sivewright presided on 9th inst. at an extraordinary meeting of the above company, when a resolution was passed winding-up voluntarily with a view to reconstruction, and he said that the step was being taken for the protection of their joint interests. But for the big fall in the price of aluminium, they would have succeeded. Messrs. L. W. Hawkins (Moorgate Street) and A. H. Gibson, were appointed joint liquidators.

Stock Exchange Notices.—The Committee has appointed a special settling day as under:—

Tuesday, December 22nd.—Toronto Power Co., Ltd.—£500,000 4½ per cent. debenture stock.

And ordered the undermentioned securities to be quoted in the Official List:—

Montreal Water and Power Co.—Further issue of £29,000 first mortgage 4 per cent. prior lien gold bonds (registered), Nos. 1,823 to 2,000 and 2,701 to 2,811 of £100 each.

Toronto Power Co., Ltd.—£500,000 4½ per cent. debenture stock.

Applications have been made to the Committee to allow the following securities to be quoted in the Official List;—

British Columbia Electric Railway Co., Ltd.—Further issue of £100,000 deferred ordinary stock.

Buenos Ayres Grand National Tramways Co., Ltd.—£819,300 5 per cent. conversion debenture stock.

Buenos Ayres New Tramways Co., Ltd.—£360,000 5 per cent. conversion debenture stock.

Eastern Telegraph Co.—The third quarterly interim dividend of 1¼ per cent. on the ordinary stock for the year ending December 31st, 1908, is announced.

The Mexican Companies.—It is announced in several daily papers that the directors of the Mexican Light and Power Co., though opposed to a lease of their company to the Mexico Tramway Co. on the terms proposed, are agreeable to amalgamation as an alternative plan.

Anglo-Argentine Tramways Co., Ltd.—The directors have declared a final dividend to December 31st, in respect of the profits of the year 1908, at the rate of 5s. per share on the second non-cumulative preference shares, being at the rate of 10 per cent. per annum, less income-tax. A final dividend to December 31st next, in respect of the profits of the year 1908, of 3s. per share on the cumulative first preference shares, being at the rate of 6 per cent. per annum, less income-tax, has also been declared.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Dec. 9	2,467	+ 30	28	40,352	— 144	14·4	..
Ayr	„ 12	366	+ 5	30	10,350	— 246	8	..
Bath	„ 9	1,251	+ 57	49	26,307	— 2,247	13	..
Belfast	„ 11	7,267	+ 352	37	134,503	— 779	37	..
Birkenhead	„ 18	2,060	+ 83	37	39,669	+ 884	13·52	..
Birmingham Corp.	„ 5	12,967	+ 197	36	228,381	— 6,900	56·46	..
Blackpool Corp.	Nov. 17	3,906	— 839	..	87,578	— 983	11·87	..
„ —Fleetw'd.	Dec. 12	454	+ 76	23	20,948	— 1,700	8·25	..
Bolton	„ 18	4,187	— 20	37	85,924	+ 1,234	26	..
Bournemouth	„ 9	2,454	— 203	36	61,533	— 3,182	21·78	..
Bradford	„ 5	8,019	— 489	35	168,487	— 52	54·9	..
Brighton	„ 13	1,389	+ 25	36	35,211	+ 775	9·5	..
Bristol	„ 11	9,540	+ 482	..	..	..	31	..
Brit. Elec. Trac. Co.								
Airdrie	Dec. 4	439	— 4	48	10,766	— 64	3·65	..
Barnsley	„ 4	317	+ 2	„	8,532	+ 433	..	..
Barrow	„ 4	399	— 37	„	11,796	— 632	5·37	..
Cavehill	„ 4	105	— 4	„	4,225	+ 156	..	..
Devonport	„ 4	682	+ 63	„	22,495	+ 388	8·85	..
Gateshead	„ 4	1,951	— 86	„	48,730	+ 40	11·25	..
Gravesend	„ 4	345	— 66	„	10,158	+ 1,681	6·5	..
Greenock	„ 4	909	— 93	„	25,346	— 6,152	7·25	..
Hartlepool	„ 4	397	— 92	„	11,505	— 2,469	6·72	..
Kidderminster	„ 4	157	— 21	„	5,843	— 421	..	..
Leamington	„ 4	269	+ 20	„	8,852	+ 582	3	..
Merthyr	„ 4	422	+ 6	„	10,259	+ 44	2·9	..
Metropolitan	„ 4	10,626	+1,894	„	278,219	+52,252	22	..
Middleton	„ 4	573	— 12	„	17,106	+ 58	8·5	..
Mid. Joint Com'tee	„ 4	11,007	— 446	„	277,137	— 6,469	..	..
Oldham—Ashton	„ 4	1,023	— 94	„	28,322	— 812	9·18	..
Peterborough	„ 4	192	— 16	„	6,150	— 26	5·31	..
Potteries	„ 4	3,763	— 143	„	87,459	— 2,652	29	..
Rothesay	„ 4	80	— 1	„	9,761	— 508	2·75	..
Southport	„ 4	405	— 11	„	13,600	— 766	8·17	..
S. Metropolitan	„ 4	1,363	+ 25	„	39,153	+ 457	..	..
Swansea	„ 4	1,750	+ 4	„	45 641	+ 1,072	12·5	..
Tynemouth	„ 4	260	— 13	„	10,872	— 783	3·75	..
Weston-s-Mare	„ 2	52	— 1	„	6,730	— 506	3	..
‡Worcester	„ 4	462	..	„	13,609	— 92	5·75	..
Wrexham	„ 4	187	+ 7	„	4,955	— 4	..	..
Yorks. Wool. Dist.	„ 4	1,634	— 31	„	44,145	— 853	17	..
Miscellaneous	„ 4	354	— 22	„	10,002	— 782	..	..
Burnley	Dec. 12	2,131	— 309	..	..	..	7·5	..
Burton-on-Trent	„ 13	474	— 27	37	10,059	— 623	10	..
Bury	„ 13	1,962	— 83	36½	43,308	+ 1,687	22·5	..
Cardiff	„ 5	3,935	— 88	36	78,278	— 107	..	..
Carlisle	„ 12	308	— 20	49	8,712	+ 18	..	..
Chatham and Dist.	„ 10	1,456	+ 207	49	38,657	+ 2,901	14·98	2·82
Cork	„ 10	858	+ 68	49	22,672	— 362	9·89	..
Croydon	„ 11	2,470	— 87	37	52,489	— 558	11·25	·75
Darlington	„ 12	358	— 30	37	7,327	— 587	..	..
†Darwen	Nov. 20	224	— 14	33	8,541	— 249	4·86	..
Dover	Dec. 5	295	— 40	26	8,169	— 357	4 75	..
Dublin	„ 11	9,739	+ 244	..	127,706	—28,337	54·25	5·5
Dundee	„ 9	2,293	+ 123	29½	86,074	+ 1,801	14·5	..
East Ham	„ 12	1,708	+ 4	37	32,577	— 1,034	8·43	·68
Exeter	„ 11	535	+ 43	37	11,567	+ 107	5·5	..
Glasgow	„ 12	33,303	— 405	..	480,766	— 8,556	90·5	1·5
Hastings	„ 10	1,486	+ 3	..	..	..	..	..
†Huddersfield	„ 5	1,357	— 178	28	57,681	— 564	28·5	·5
Hull	„ 12	4,752	— 209	37	90,824	— 481	13	..
Ilkeston	„ 9	234	— 17	36	5,232	+ 66	3·5	..
Ipswich	„ 12	578	— 88	37	14,840	— 371	10·5	..
Kilmarnock	„ 5	278	— 10	29	4,448	— 265	4·25	..
Lan'kshire Trm. Co.	„ 10	2 347	— 69	49	63,301	+ 3,101	17	1·18
Lancashire United	„ 9	2,239	+ 40	49	65,179	+ 2,334	89	1
Leeds	„ 5	11,505	— 396	33	238,234	+ 3,449	96·75	·25
Leicester	„ 12	4,108	— 65	..	..	..	..	..
Leith	„ 5	968	+ 29	29½	15,759	— 5	6	..
†Liverpool	Nov. 28	10,280	+ 147	48	512,324	—10,302	104	..
†L.C.C.	„ 28	67,944	+8,756	..	1,226,817	+188,411	121½	..
London United	Dec. 12	10,047	— 785	..	326,215	+ 3,442	..	..
Lowestoft	„ 12	292	— 18	11	1,781	— 103	3·5	..
Manchester	„ 12	28,231	— 84	37	560,269	+14,226	89·5	11
Newcastle	„ 12	7,626	— 292	37	143,9·6	— 8,097	..	..
†Newport	„ 5	686	— 36	36	23,930	— 1,144	14·5	..
†Northampton	Nov. 10	482	+ 752	27½	13,577	..	5·5	..
Oldham	Dec. 13	3,497	— 254	37	73,431	— 654	23·75	..
Pontypridd	„ 5	748	+ 215	36	13,784	+ 4,089	5·5	1·75
Portsmouth	„ 12	3,181	+ 194	37	75,935	+ 811	14·5	..
Preston	„ 9	1,323	— 40	..	..	..	..	..
Reading	„ 10	1,076	— 90	36	22,842	— 26	13·25	..
Rotherham	„ 10	1,105	— 45	36½	22,408	+ 41	10	·66
Salford	„ 14	8,490	— 245	37	173,510	+ 673	41·25	..
Sheffield	„ 13	10,520	— 413	36½	209,062	— 2,937	37	1·25
Southampton	„ 9	1,831	— 57	36	39,548	+ 1,484	..	..
Southend-on-Sea	„ 9	596	+ 70	37	17,364	+ 1,628	..	..
South Shields	„ 12	962	— 30	37	20,853	— 366	..	..
†Swindon	„ 9	114	— 37	..	..	..	4·4	..
Tyneside	„ 9	748	— 4	23	9,673	— 916	8·87	..
Wallasey	„ 12	1,594	+ 102	36½	33,381	+ 1,798	8·72	·22
Walthamstow	„ 12	983	+ 33	37	23,975	+ 1,215	9	..
West Ham	„ 3	4,220	— 45	35	79,894	— 3,852	15	·3
Wolverhampton	„ 9	1,499	— 74	36	30,547	— 757	12·5	..
Baker St.-Waterloo	Dec. 12	6,525	+ 545	24	73,180	+13,135	4·25	1
Cen. London Rly.	„ 12	11,540	— 539	24	171,916	+45,369	6·22	·55
Char. +, Ens. Hamp.	„ 12	7,130	+1,280	24	90,900	+17,275	7·75	..
City & S. Lon. Rly.	„ 13	6,453	— 485	24	78,022	— 2,486	7·3	1·05
Dublin-Lucan Rly.	„ 11	217	+ 51	23	2,291	+ 92	7	..
G.N. and City Rly.	„ 12	2,929	— 747	24	32,965	— 8,135	3·5	..
G.N., P'dy. & Brmtn.	„ 12	11,440	+1,215	24	124,015	+20,995	9·25	·25
†L'pool Overh'd Rly.	„ 6	1,280	— 61	23	22,110	— 3,600	6·8	4·3
Mersey Railway	„ 12	4,008	+ 238	24	45,381	+ 1,123	4·5	..
Met. District Rly.	„ 12	20,019	+2,618	24	224,682	+35,170	24	..
Anglo-Argentine	„ 9	54,910	+16,52	49	1,058,275	+231,756	43	..
‡Auckland	„ 4	13,524	+1,7967	48‡	149,870	+23,519	23·3	3·1
Bombay (B.E.T.)	Nov. 19	5,419	+ 543	45	111,378	+19,191	..	..
‡Brisbane	„ 30	14,504	+ 984	..	..	..	..	..
Calcutta	Dec. 12	6,728	+4,160	..	..	..	..	..
‡Kalgoorlie, W.A.	Nov.	3,771	..	48	42,957	..	20·3	..
Madras	„ 15	1.149	— 18	46	25.927	+ 1,800	12·75	..
Perth (W.A.)	Dec. 11	2,877	+ 55	50	68,295	— 1,384	25·48	..

* Compared with the corresponding period of 1907. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

It is the Balkans business which now provides the principal hub upon which Stock Exchange prices revolve. The peace prospects look clearer, and quotations reflect the cheerfuller view. Again, the cables bring what is read as bad news, and a slide starts again. May be the outstanding financial feature is the multitude of new issues which are crowding upon one another's heels before Christmas, while others are known to be in course of preparation for launching early in the New Year. Really cheap stock goes off like the proverbial hot cakes; other issues find that the public taste is fickle as ever.

The boom in electricity supply shares is over, for the time being, but the market finds a fair amount of quiet support still accorded. Prices more than hold their rises, and there has been no further progress made with the fall which threatened to break out last week. Charing Cross, City of London, and Westminster Ordinary are all ⅛ better. Brompton and Kensington Ordinary regained their lost 5s.; County of London put on 10s. and the Second Debenture Stock a point. London Electric Preference hardened 2s. 6d. On the other side of the shield, Chelseas are again lower. South Metropolitan Ordinary have held their substantial rise.

Movements in the Mexican group are upward, upon the renewal of the hope that working agreement or amalgamation may yet be possible. The Light and Power Company's issue gained ⅜ to 1⅛, and the Tramways shares rose 1½ to 139. Rio Trams put on 2½ to 79½, Sao Paulos remained strong at 160. There are rumours that the latter may be split. The incessant Mexican circulars are becoming rather tiresome.

British Columbia Railway 4½ per cent. First Debentures rose 1 on the issue of half a million new 4½ per cent. Debenture stock at 99. The existing stock, of which the new forms part, is quoted 98 to 102, the next half-year's interest payment being due on March 30th, 1909. The new stock carries a small advantage, in that it will receive a full six months' interest next September 30th, although the last call is not due until July 6th.

British Electric Traction Preference are ⅛ down to 3⅞, but the First Debenture is a point better, after being weak.

Anglo-Argentine Tramways Second Preference strengthened to 9⅜, although there is yet another Buenos Ayres Tramways Company projected, and an issue of the new company's First Debentures may be out before long.

The "old Underground" railway stocks are good, on the weather, a mud-spattered member suggested. Metropolitan Consolidated and Districts are both higher. Other Tube stocks have hardly moved, but the dividend declaration from the Central London is awaited with considerable curiosity. City and South London shed ½. Great Northern and City Preferred shares continue to be quoted at 5s. to 15s. Underground Electric Railways 6 per cent. Income bonds have more than regained their fall of last week, and Prior Lien bonds are up again to 93½.

Telegraph stocks and shares were naturally not rendered any the more buoyant by the Mansion House meeting last week in support of cheaper cables. Bearing in mind their previous tendency to weaken under wireless telegraph influences, it is, perhaps, rather surprising that prices have not given way more than they have done. Anglo-Americans are very flat on the call for cheaper cables to Canada; the Ordinary and Preferred show heavy losses, as well as the Deferred. The Eastern group, however, is unchanged except for ½ fall in Eastern 3½ per cent. Preference stock. West India and Panama Seconds lost 5s, while the Debenture stock moved up 10s. Indo-Europeans lost another sovereign. The Trust companies' issues have not moved.

National Telephone First and Second Preferences are both 5s. better, otherwise telephones have been inanimate.

The manufacturing list is featured by a rise of 3 in British Westinghouse 4 per cent. Debenture, a speculative buyer finding some difficulty in picking up any stock at all. The 6 per cent. Prior Lien Debentures are changing hands fairly often upon the basis of 95½—96½. British Aluminium Preference of both kinds continue to advance. British Insulated Preference rose 2s. 6d., and Callender's Preference, showing 2s. 6d. fall, are *ex* the same amount for dividend. Inquiry for General Electric Co., Ltd., Preference caused the price to rise 5s., though the 4 per cent. Debenture stock at 85 is a point lower. Telegraph Constructions receded. Rubber shares remain idle and dull, and Industrials on the whole have just cause for complaint that they are neglected by the public.

Eastern Extension, Australasia and China Telegraph Co.—An interim dividend of 2s. 6d. per share for the quarter ending September 30th last has been declared.

United River Plate Telephone Co.—An interim dividend of 6 per cent. on the ordinary shares for the half-year is announced.

France.—The report and balance-sheet of the Société des Trefileries du Havre (anciens Etablissements Lazare Weiler), for the last financial year, shows a profit of £119,528, as compared with only £87,710 in the preceding 12 months; a dividend of 10 fr. per share is being declared.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations Dec. 8th.	Closing Quotations Dec. 15th.	Business done week ended Dec. 15th, 1908. Highest	Lowest.	Rise + or Fall −	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2¼ — 3¼	2¼ — 2¾	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,350 Red.	100	Nil	5 %	5 %	5 %	92 — 95	92 — 95	..	..	..	5 5 3
$131,561,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	7½%	8 %	8 %	132 —135	132 —135	..	..	..	5 18 6
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
598,180	Anglo-American Telegraph	Stock	2¾%	3½%	3¾%	3½%	58 — 61	55 — 58	..	..	—3	6 0 8
3,200,910	Do. do. do. 6 % Pref.	Stock	5¾%	6 %	6 %	6 %	102 —103	97½— 99½	101½	97½	— 4	6 0 7
3,200,910	Do. do. do. Deferred	Stock	Nil	½%	1¾%	1 %	16⅝— 16⅞	15½— 15¾	16¼	15¼	—1½	6 8 0
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 8½	8 — 8¾	..	..	..	4 14 1
2,583,376	Commercial Cable Sting. 500 year 4 % Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	87 — 89	87 — 89	88¼	87½	..	4 9 11
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	7¼— 8¼	7¼— 8¼	8	..	..	7 1 2
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16½— 17½	16½— 17½	..	..	..	5 15 11
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	8 — 8½	8 — 8½	..	..	..	5 14 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 9	8 — 9	..	..	..	5 8 1
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	3 14 10
60,710	Direct United States Cable	20	3½%	4½%	4½%	4½%	13 — 13½	12½— 13½	..	..	— ½	6 8 4
48,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	129 —134	129 —134	132	129	..	5 4 6
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	83½— 85½	83 — 85	84	83	— ½	4 2 4
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	103½—105½	103½—105½	103¾	103½	..	3 17 8
800,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	11½— 12	11⅝— 12	11⅝	11½	..	5 16 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	101 —102	101½	101½	..	3 17 8
269,700	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
300,000	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	99½—101½	99½—101½	..	..	..	3 18 10
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	5½%	10⅜— 10⅝	10⅜— 10⅝	10⅞	10⅜	..	5 11 2
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	12½— 13⅛	12½— 13⅛	13⅛	13	..	4 9 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24 %	24 %	20 %	20 %	30 — 32	30 — 32	..	..	..	6 5 0
14,800‡	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,900, Red.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	54 — 57	55 — 56	53	..	..	6 11 7
$41,380,400	Mackay Companies Common	$100	1 %	2 %	3½%	4 %	78 — 82	76 — 80 xd	..	..	..	4 17 7
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	70 — 74	70 — 73 xd	..	..	..	5 8 1
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅜— ⅝	⅜— ⅝	10/7½	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	4 %	5 %	6 %	6 %	¾— 1	¾— 1	..	..	..	6 0 0
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	31/32— 1 1/32	31/32— 1 1/32	..	..	..	5 3 11
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	108½—110½	108½—110½	109½	109½	..	5 8 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	5 %	6 %	116 —118	116 —118	117	116½	..	5 1 8
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¾— 11¼	10¾— 11¼	10⅞	..	+ ¼	5 4 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10¾— 11¼	10¾— 11¼	..	..	+ ¼	4 6 11
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅞— 6⅛	5⅞— 6⅛	..	..	..	4 7 1
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	..	..	..	3 10 4
1,716,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	101 —103	101 —103	102½	101½	..	3 17 8
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	6¾%	7 %	7 %	8 %	1⅛— 1⅜	1⅛— 1⅜	..	..	..	5 16 4
50,000	Do. do. do. 6 % Cum. Pref.... ..	1	6 %	6 %	6 %	6 %	1⅛— 1⅜	1⅛— 1⅜	..	..	..	4 16 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	..	4 %	4 %	4 %	90 — 92	90 — 92	..	..	..	4 7 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 4
11,889	Reuter's	8	5 %	5 %	5 %	5 %	7 — 8	7 — 8	..	..	..	5 0 0
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	4 7 10
3,088	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	127 —130	127 —130	127½	..	..	4 12 4
100,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅝— 7⅛	6⅝— 7⅛	7	6½	..	5 16 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 11
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2½	Nil	Nil	2½%	2½%	1¼— 1½	1¼— 1½	..	..	..	4 3 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	7 %	12⅜— 13½	12⅜— 13½	13	12⅜	..	5 5 8
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102 —104	102 —104	..	..	..	3 16 11
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅛— ¼	⅛— ¼	..	..	..	Nil
84,563	Do. do. 6 % Cum. 1st Pref.	10	6 %	5 %	8 %	6 %	7⅞— 8⅛	7⅞— 8⅛	..	..	..	7 7 8
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	£2 6	7¾— 8¼	7¾— 8¼	7⅞	7⅝	— ⅛	2 14 1
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101½—103½	102 —104	..	..	+ ½	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	8 %	8 %	8 %	9 %	9⅛ — 9⅜	9⅛— 9⅛	9⅜	9 3/16	+ ⅛	4 14 9
260,007	Do. 6 % Cum. Prefs., 1 to 260,007 ..	5	5½%	5½%	5½%	5½%	6⅜ — 6⅝	6⅜— 6⅝	6⅛	6 1/16	..	6 4 4
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	143 —148	143 —148	144½	143	..	4 2 2
265,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 3
580,000	Babcock & Wilcox, 1 to 580,000	1	20 %	20 %	20 %	20 %	3 1/16— 4 1/16	3 1/16— 4 1/16	80/7½	79/4½	..	4 18 2
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16— 1 1/8	1 1/16— 1 1/8	42/6	38/9	..	3 13 10
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	2⅛— 2⅜	1⅞— 2⅛	65/-	58/9	+ ⅛	15 11 2
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	2⅞— 3⅛	3 — 3½	..	..	+ ¼	10 0 0
40,000	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅞— 4⅛	3⅞— 4⅛	..	..	..	7 1 2
12,597	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3¾— 4⅛	3¾— 4⅛	..	..	..	4 8 11
43,478	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	105 —108	105 —108	..	..	..	4 12 7
800,000	Do. do. 5% Loch Leven Debs. ..	100	..	..	5¾%	5¾%	98½—100½	98½—100½	..	..	..	5 9 5
400,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	6 %	6 %	8 %	134 —138	134 —138	137½	136	..	5 15 11
400,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	116 —120	116 —120	117½	..	..	4 11 4
800,000	Do. 5 % Cum. Perp. Pref. Stock ..	100	5 %	5 %	5 %	5 %	107½—109½	107½—109½	109½	..	..	4 11 9
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250 ..	40	4½%	4½%	4½%	4½%	101 —103	102 —104	..	..	+1	10 15 5
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
138,301	British Electric Traction	10	6 %	3 %	Nil	Nil	1⅝— 1 1/16	1⅝— 1⅞	21/10½	20/-	..	Nil
161,497	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	3 %	3⅞— 4¼	3⅞— 4⅛	76/3	..	— ⅛	7 1 2
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	91 — 96	92 — 97	92	91½	+1	5 3 1
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	73 — 75	73 — 75	..	..	..	6 0 1
100,000	British Insulated and Helsby Cables	5	8 %	8 %	10 %	10 %	6½ — 7	6¾ — 7	6 3/16	..	..	7 2 10
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6 — 6⅜	6⅛— 6½	..	..	+ ⅛	4 12 4
600,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	104 —107	105 —108	107½	..	+1	4 8 4
208,440	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 13 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	⅜— ⅝	⅜— ⅝	..	..	..	Nil
1,016,368	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	40 — 45	43 — 48	44½	..	+3	8 6 8
50,000	‡ Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	⅜— ½	⅜— ½	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,781	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	Nil	2½%	Nil	Nil	..	..	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	Nil	Nil	..	..	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	4½%	65 — 70	65 — 70	..	..	..	6 8 7
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	49 — 53	49 — 53	..	..	..	8 9 10
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	8 %	6 %	4⅛— 5	4⅛— 5	..	..	..	6 0 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,320..	5	..	5 %	5 %	5 %	4⅛— 5⅛	4⅛— 5⅛	98/9	..	..	4 15 3
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
85,000	Callender's Cable Construction shares	5	12½%	15 %	15 %	15 %	9 — 10	9 — 10	..	..	..	7 10 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛— 5⅜	5⅛— 5⅜ xd	5⅛	..	..	4 8 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	107½—109½	107½—109½	..	..	..	4 2 2
491,222	Cape E Trams., 1 to 491,222	1	5 %	Nil	Nil	Nil	⅛— ¼	⅛— ¼	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	6 %	8 %	12 %	1⅛— 1⅜	1⅛— 1⅛	32/-	31/6	..	7 10 4
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4½%	103 —107	103 —107	..	..	..	4 6 11
1,898,610	Central London Railway, Ord. Stock..	Stock	4 %	4 %	4 %	3 %	64 — 66	64 — 66	65	..	..	4 10 11
658,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	84 — 86	..	..	..	4 13 0
658,195	Do. do. Def. do.	Stock	4 %	4 %	4 %	2 %	50 — 52	50 — 52	..	..	..	3 16 11
1,480,000	City and South London Railway	Stock	2½%	12½%	20%	25%	29½— 30½	29 — 30	30	29⅜	— ⅛	7 1

* Unless otherwise stated, all shares are fully-paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Dec. 8th.	Closing Quotations Dec. 15th.	Business done week ended Dec. 15th, 1908.		Rise + or Fall —	Present Yield per cent.
		*	1904.	1905.	1906.	1907.			Highest	Lowest.		£ s. d.
85,000	Crompton & Co., Nos. 1 to 85,000	£	2½%	2½%	5 %	5 %	1⅝— 1¾	1⅝— 1¾	26/3	..	..	10 0 0
100,000§	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	98 —101	98 —101	..	..	..	4 19 0
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1⅝— 1¾	1⅝— 1¾	..	..	..	7 2 10
305,000	Do. do. 5 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1⅛— 1⅛	1⅛— 1⅛	..	..	..	5 1 1
276,880	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6 %	6%	6 %	6¼%	11½— 12½	11½— 12½	..	..	..	5 4 0
60,000	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 5 9
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	£	2½%	4½%	4½%	4½%	⅛— ¼	⅛— ¼	..	..	..	16 12 6
17,189	Do. "A" shares, 01—017,189	£	2½%	4½%	4½%	4½%	1¾— 2¼	1¾— 2¼	..	..	..	8 6 9
317,875	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	76 — 79	76 — 79	..	..	..	5 1 3
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	86 — 89	86 — 89	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	£	4 %	Nil	Nil	Nil	⅜— ⅝	⅜— ⅝	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	£	7 %	7 %	7 %	7 %	1 — 1¼	1 — 1¼	..	..	..	9 6 8
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	7 — 7⅛	7½ — 7⅝	..	..	+ 1/16	6 17 11
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	84 — 88	83 — 87	..	..	—1	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	4 %	4¼%	⅛— ¼	⅛— ¼	..	..	..	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10¼— 10⅝	10¼— 10⅝	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103½	..	..	+ ⅛	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	£	15 %	15%	15 %	15%	11½— 12½	11½— 12½	..	..	..	6 0 0
40,000	Do. do. 4½ % Pref.	£	4½%	4½%	4½%	4½%	5 — 5½	5 — 5½	5 1/16	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105 — 107	105 —107	106¼	..	..	4 4 1
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	5 %	10%	10 %	10 %	16⅝— 17⅜	16⅝— 17⅜	..	..	..	8 1 7
37,500	†Liverpool Overhead Railway, Ord.	10	1½%	Nil	Nil	1½%	1 — 1⅛	1 — 1⅛	..	..	..	4 7 6
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4 — 4¼	4 — 4¼	..	..	..	11 2 3
600,070	London United Trams. (1901), 1 to 60,007	10	6 %	3 %	3 %	3 %	6½— 6⅝	6½— 6⅝	..	..	..	4 8 11
399,930	Do. do. 60,008 to 100,000	10	6 %	3 %	3 %	3 %	6½— 6⅝	6½— 6⅝	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5 %	4¾— 5⅛	4¾— 5⅛	97/6	..	..	9 1 10
1,881,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	67 — 72	67 — 72	70⅜	69½	..	5 11 1
5,722,062	Metropolitan Consolidated	100	3 %	2¾%	1 %	1¾%	35½— 36⅛	36 — 37	37⅛	35⅜	+ ⅛	1 7 1
2,640,914	Do. Surplus Lands	100	2¾%	2¾%	2¾%	2¾%	67 — 69	67 — 69	..	..	..	8 19 9
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	12⅞— 13⅛	13⅜— 13⅝	13⅝	13⅛	+ ⅛	Nil
314,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	Nil	⅜— ⅝	⅜— ⅝	..	..	..	Nil
600,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅝— ¾	¾— ⅞	15/9	..	..	5 19 5
822,800	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	92 — 95	93 — 96	94½	94	+1	4 13 9
245,500	Potteries E. Trc.	£	5 %	4 %	4 %	4 %	⅛— ¼	⅛— ¼	..	..	..	8 0 0
245,500	Do. 5 % Cum. Pref.	£	5 %	5 %	5 %	5 %	⅛— ¼	⅛— ¼	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	90 — 93	90 — 93	93½	93½	..	4 14 9
37,850	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	17½%	31 — 33	30½— 32½	32	30½	— ½	7 14 11
150,000§	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101½—103½	101½—103½	..	..	..	3 17 8
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	..	92½— 93½	93 — 94	94	92⅝	+ ½	..
2,800,000	Do. do. 4½% Bonds	..	..	..	..	..	73 — 75	73 — 75	..	..	..	..
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	18 — 20	20 — 22	21⅜	21½	+2	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	Nil	Nil	10 %	2⅝— 2¾	2⅝— 2¾	..	..	..	10 0 0
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	£	Nil	Nil	..	6 %	2⅝— 2¾	2⅝— 2¾	..	..	..	10 8 8
246,404	Do. 4 % 1st Mort. Deb. Stock	..	4 %	4 %	4 %	4 %	68 — 72	68 — 72	..	..	..	5 11 1

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	£	5½%	5½%	5½%	5½%	4⅜— 4¾	4⅜— 4¾	..	..	..	5 11 5
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	94 — 98	94 — 98	..	..	..	4 10 0
30,275	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	£	10 %	10 %	10%	10 %	8¼— 8⅝	8¼ — 9	8⅛	8⅝	+ ⅛	5 12 8
9,725	Do. do. 7 % Cum. Pref.	£	7 %	7 %	7 %	7 %	8 — 8½	8 — 8½	8½	..	..	4 2 4
836,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	98 — 101	99 —101 xd	..	..	..	3 19 3
80,000	Charing Cross and Strand Electricity Supply	£	8 %	5 %	5 %	5 %	4¼— 4⅝	4⅜— 4⅞	91/6	86/3	+ ⅛	5 2 7
80,000	Do. do. 4½ % Cum. Pref.	£	4½%	4½%	4½%	4½%	4⅜— 4⅝	4⅛— 4⅝	85/7½	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	£	4½%	4½%	4½%	4½%	3⅞— 4⅛	3¾— 4⅛	..	..	..	5 16 2
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..	4 1 8
49,486	Chelsea Electricity Supply, Ord.	£	6 %	6 %	4½%	4½%	3⅞— 4⅛	3⅞— 4¼	..	..	— ⅛	5 5 11
175,000§	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10 — 10½	10⅛— 10⅜	10½	10 5/16	+ ⅛	5 11 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12½— 13	12½— 13	..	..	..	4 12 4
400,000§	Do. 5% Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	123 —125	123 —125	..	..	..	4 0 0
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	101½	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	£	£8 7 0	4 %	4 %	2 %	2¾— 3	2¾— 3	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref.	£	5 %	5 %	5 %	5 %	3¾— 4	3¾— 4	..	..	..	6 5 0
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	..	99 —101	99 —101	..	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4½%	5 %	5 %	5 %	8⅛— 8¾	8⅜— 9⅛	9⅛	8⅞	+ ⅛	5 8 1
50,026	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½— 11	10⅝— 11⅛	11	10 1/16	+ ⅛	5 6 8
400,000§	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	107 —110	107 —110	..	..	..	4 1 10
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	97 —100	98 —101	..	..	+ 1	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares	£	7 %	4 %	Nil	Nil	1/16— 1/8	1/16— 1/8	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	£	6 %	6 %	3 %	Nil	⅛— ¼	⅛— ¼	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	62 — 65	62 — 65	64	..	..	6 18 6
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	..	84 — 86	84 — 86	85	84	..	..
10,000	Folkestone, 1 to 10,000	£	5½%	5½%	5½%	5½%	4¾— 5¼	4¾— 5¼	..	..	..	5 4 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	£	..	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 — 100	..	..	..	4 10 11
15,000	Hove, 1 to 15,000	£	8½%	9 %	9 %	8½%	6¼— 6⅝	6¼— 6⅝	..	..	..	6 8 4
$1,325,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	..	95 — 96	95 — 96	96	95⅞	..	..
21,000	Kensington and Knightsbridge Electric Ord.	£	12 %	10 %	10 %	10 %	7⅞— 8¼	7⅞— 8¼	..	..	..	6 1 3
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 2 6
111,000	London Electric Supply Corporation, Limited, Ord.	£	3 %	3 %	4 %	2½%	1⅜— 1⅝	1⅜— 1⅝	28/9	..	..	4 0 0
70,000	Do. do. do 6 % Pref.	£	6 %	6 %	6 %	6 %	4½— 5¼	4½— 5⅜	5⅛	5	+ ⅛	5 11 8
374,895	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4½%	4½%	91 — 94	89 — 93	92	91⅜	—1½	4 16 9
200,000	Metropolitan Electric Supply, 1 to 100,000	£	10 %	10 %	8 %	6¾%	5½— 5⅝	5 — 5⅜	5⅛	5 1/16	— ⅛	5 18 2
76,121	Do. 4½ % Cum. Pref. 1—71,106	£	4½%	4½%	4½%	4½%	4⅝— 5⅛	4⅝— 5⅛	..	..	..	4 7 10
220,000§	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	107 —110	107 —110	109	107⅞	..	4 1 10
248,000§	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	85 — 88	85 — 88	85⅛	85⅛	..	4 2 4
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	$100	5 %	5 %	5 %	5 %	84 — 86	86½— 87½	87⅛	85⅝	+2½	5 14 3
$18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	..	76 — 77	76½— 77½	77⅛	76⅛	+ ⅛	..
$1,500,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	..	103¼—105½	103¼—105½	105	103½	..	..
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	..	87 — 88	89 — 90	89⅜	87½	+2	..
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
87,500	Newcastle-on-Tyne, 1 to 87,500	£	8 %	8 %	8 %	8 %	4⅝— 5⅛	4⅝— 5⅛	..	..	..	7 16 1
87,500	Do. 5 % Pref., 1 to 87,500	£	5 %	5 %	5 %	5 %	5⅛— 5⅜	5⅛— 5⅜	..	..	..	4 10 11
10,852	Notting Hill Electric Lighting	10	7 %	7½%	7½%	7½%	11½— 12½	11½— 12½	..	..	..	5 17 8
20,000	Oxford, 1 to 96 and 407 to 20,810	£	7 %	7 %	7 %	7 %	5½— 6⅛	5½— 6⅛	5⅛	..	..	5 12 0
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	..	2½%	..	1⅝— 1⅞	1⅝— 1⅞	..	..	..	..
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6	6	6	6	1⅝— 1⅞	1⅝— 1⅞	20/6	..	..	..
194,684	Do. do. 5% Deb. Stk. Red.	100	5	5	5	..	100 —103	100 — 103	..	..	..	4 17 1
40,000	St. James' and Pall Mall Electric Light, Ord.	£	14½%	12½%	10 %	10 %	8⅝— 9⅛	8⅝— 9⅛	8⅛	8⅝	..	5 9 7
20,000	Do. do. 7 % Pref. 20,081 to 40,080	£	7 %	7 %	7 %	7 %	7 — 7⅛	7 — 7⅛	..	..	..	4 13 4
150,000§	Do. do. 3½ % Deb. Stock Red.	100	3½%	3 %	3½%	3½%	87 — 91	87 — 91	..	..	..	3 16 11
12,000	Smithfield Markets Electric Supply, Ord.	£	4 %	4 %	Nil	Nil	⅝— ¾	⅝— ¾	..	..	..	Nil
45,700	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	68 — 72	68 — 72	..	..	..	5 11 1
65,000	South London Electricity Supply, Ord.	£	4 %	4 %	3 %	4 %	2⅝— 3	2⅝— 3	57/6	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	£	Nil	2½%	2½%	2½%	⅜— ½	⅜— ½	..	..	..	3 6 8
142,968	Do. do. 7 % Pref.	£	7 %	7 %	7 %	7 %	1⅝— 1⅞	1⅝— 1⅞	24/4½	..	..	5 16 8
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100—103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	£	5 %	5 %	5 %	5 %	⅝— ¾	⅝— 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	£	5 %	5 %	5 %	5 %	1⅝— 2	1⅝— 2	..	..	..	12 10 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	80 — 83	80 — 83	..	..	..	5 8 5
800,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	..	7/16— 15/16	7/16— 15/16	18/1½	17/6	..	..
110,000	Westminster Electric Supply, Ord.	£	14 %	13 %	12 %	10 %	8⅛— 8⅜	8⅛— 8⅜	8⅜	8 7/16	+ ⅛	5 12 8
81,979	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	£	5 %	5 %	4½%	4½%	5 — 5⅛	5 — 5⅛	..	..	..	4 3 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. § Interim Dividend.

Bank rate of Discount 2½ per cent., May 28th, 1908.

ELECTRIC MANUFACTURING COMPANIES' ACCOUNTS.

In the following article a number of matters in connection with the affairs of an electrical manufacturing company are touched upon, the writer having taken as a basis for his statements a firm engaged in the business of manufacturing for, and adapting machinery and apparatus to the purposes of, heating and cooking by electricity.

Purchases.—These may be divided into (*a*) materials and stores, and (*b*) finished articles and machinery for electrical adaptation, the former being utilised in the process of manufacture, and forming one of the essential elements of prime cost and consequent production.

All orders placed should be on the usual printed forms containing the ordinary and any special conditions, and if the volume of business be small, it will be found sufficient (instead of adopting a purchase-book, in which each invoice, less any trade discount, is entered and posted to the credit of the personal account, with analytical columns for the allocation of the purchases, which are posted to the proper nominal accounts) if the invoices are pasted in a well-bound guard-book, after having been checked with the orders issued, and marked accordingly so that at any time it may be easy to ascertain particulars and values of orders outstanding, invoices not received for particular items, and so on. All such purchase accounts should be directly allocated to "Materials and Stores" and "Stock," and after being certified and allocated according to the usual method, they should be pasted carefully in a guard book, each invoice being numbered, endorsed, indexed and posted to the credit of the personal account, and the debit of the nominal account, affected—the latter may be posted in total. There are alternative methods, including the abolition of personal accounts; but the foregoing will be found sufficient for all small businesses if it be enjoined that no invoice must be pasted in the guard book until it has been properly passed and paid, and that once having been posted therein it must not on any account be removed.

Particulars of the credits or returns to stores or transfers may be recorded on a separate form designed somewhat as below :—

Date.	Department or work from which received.	Particulars.	Amount.

The stores clerk will attach all the executed requisitions in datal order for the purpose of entering them in the stores ledger or stores issued book, which is posted to the former book, and for preparing the weekly or other periodical statements of cost, which may be utilised for the purpose of entering the issues and credits of stores against each work or other account in the cost ledger. Certain check devices may be instituted here and there into a description of which it is unnecessary to enter. To the contracts and manufacturing ledger, which may be in the form which appears later, will be posted the summaries of the statements referred to. For example, all issues of stores *ex* stores stock will be :—Particular works account Dr. to stores stock; whilst issues of finished articles will be particular works account Dr. to stock account, and inversely as regards materials or stock re-entered, and so on. The summaries may be entered in the stores issued summaries book and posted therefrom, or they may be journalised in the usual way.

We may outline the form of requisition, which we have mentioned, as shown below :—

..... Date

Quantity or weight.	Description.	Allocation.	For use of stores and costing department.		
			Price.	Amount.	Total.

..... Signature

Many types of requisition are in use, but the above will serve our purpose.

Costing and Stores.—Just as you may err to its detriment on the side of centralisation or decentralisation, as the case may be in the organisation of a business, so you may, in costing, aggregate or segregate the component elements to such an extent as more or less to render obscure essential requirements.

Cost Book. ..... Work or Contract.

Date.	Particulars.	Materials and stores.	Stock.	Wages.	Sundries.	Total.	Date.	Particulars.	(Credits.)	Total.

No stores should be permitted to be taken from the stores stock, except upon the production of a duly authenticated requisition, and the person responsible for the stores should see that there is no relaxation of this cardinal and essential rule, whilst no stores or materials should be taken back into stores without a corresponding credit to the person in charge of the producing or manufacturing department. Similarly in regard to finished stock articles. This, of course, will contribute to accuracy of costing and a strict supervision over the reception, custody, and issue, of stores and any re-entry to stores. At the end of each week or month, as may be desirable, the person in charge of the books should receive from the stores clerk, who may also act as costing clerk, a statement somewhat as follows :—

Stores issued for the.....ending..... 19...

Date.	Requisition.	Particulars.	Contract, work or other allocation.	Amount.	Remarks.

Summary ...

Contract, work or other allocation.	Amount.
Total	

A similar statement will be prepared by the person in charge of the finished stock manufactures and purchases.

The cost of an article may be summed as follows :—

Materials and stores. Inward carriage or freight thereon. Wages.	A. Prime cost.
+	
Rent, rates and taxes of workshops, factory, &c. Fire insurance of ditto, including machinery. Superintendence. Wages of workshop clerks, packers, &c. Repairs and maintenance of machinery. Depreciation.	B. Production cost.
+	
Advertising. Travelling salaries, canvassers and expenses. Printing and stationery (proportion of). Bad debts. Carriage and freight on goods sold.	C. Distribution cost.
+	
Rent, rates and taxes. Cash discounts. Office expenses. Office salaries. Printing and stationery (proportion of). Directors' fees. Debenture interest. Repairs. Depreciation of office furniture, buildings, &c.	D. Administration cost.

A is a direct charge.

B may be distributed over each work or contract, in proportion to its amount.

C and D may be distributed upon a percentage of the wages incurred on each work, contract, stock order, &c.

When stores are issued they are, of course, allocated to the work in which they are intended for consumption at cost, a separate account being kept of each manufacturing order in the cost book, as already shown :—

Wages.—There are several systems in vogue of recording workmen's time. We shall suppose for the purpose of our small works, that a daily time ticket is in use, as follows :—

No. ..... Name ..... Grade .....
..... Day ..... Date.

Commenced work.	Left work.	Intervals. From.	Intervals. To.	Time.	Particulars of work.	Allocation by foreman.

Time ..... Rate ..... Amount .....
..... Foreman.

The time tickets are handed to the cost and stores clerk each morning, and entered in the wages book, as follows :—

Wages for week ending ..... 19 .....

No.	Name.	Grade.	Amount. F.	S.	S.	M.	T.	W.	T.	Total.	Deductions.	Amount payable.

The weekly wages are then summarised, as follows, and treated similarly to the stores summaries :—

Account to debit.	Amount.

From this allocation will be obtained the necessary figures for the wages column in the Cost Ledger, whilst the allocations will be posted to the debit of the various contracts, works, &c., in the Contracts and Manufacturing Ledger maintenance, and other accounts in the impersonal ledger and credited to Wages Account, which will be opened in the nominal ledger.

Wages may be paid on the time work system, piece work system, contract system, the premium system, and incidentally we may have an assimilation of the profit sharing system by distributing amongst the employés a certain proportion of the profits. Detailed consideration of these systems, however, is beyond the scope of the present article. Incidentally, it may be observed that the principle of the premium system is that the workman receives a money sum in proportion to the time saved out of the standard time allowed for the execution of a given work, operation, or process. There are several variations and innovations in the calculation of the premium. Let us suppose, for example, that six hours is the standard time adopted for the completion of a certain work, and that it is finished in four hours, the standard rate of pay being 8d. per hour, the workmen would receive :—

Four hours at 8d. ... ... = 32d.
Time saved or intensity of production, say, 33 per cent., and 33 per cent. of 32d. ... ... = 10d.

Amount payable, say, ... = 42d. = 10·5d. per hour.

A sharing of the premium, as shown below, may be introduced :—

Four hours at 8d. ... ... = 32d.
Two hours at 8d. = 16d., half of which is ... ... = 8d.

Amount payable ... ... 40d. = 10d. an hour.
Or we may have four hours at 8d. ... = 32d.
Two hours at 8d. = 16d. =
One-third of which is ... ... = 5·33d.

Amount payable, say, ... 37·33d. = 9·33d. an hour, and so on.

Salaries.—Allocations of salaries will be treated similarly to those of wages, and a proportion assigned to "Indirect Charges" or "on cost."

Cash Book.—The Cash Book may be designed as follows :—

Date.	Ledger folio.	Particulars of receipts.	Discounts.	Cash sales.	Details.	Bank.	Date.	Ledger folio.	Particulars of payment.	Discounts.	Details.	Bank.

Whilst the Petty Cash Book may assume the following outline :—

Date.	Cash book folio.	Receipts. Particulars	Receipts. Amount.	Date.	Payments. Particulars.	Payments. Amount.	Allocation. Materials and stores.	Stock.	Com. on sales.	Com. on stock.	Com. on purchases.	Office wages.	Printing, &c.	Office expenses.	And so on.

The cash transferred from time to time from the cash book to the petty cash book should follow the imprest system, and would, of course, form a credit in the former, and a debit in the latter book, the allocations in the petty cash book being posted directly to the respective accounts raised in the nominal ledger.

Sales.—For sales effected over the counter—cash sales—a carbon invoice will be given to the purchaser, and a printed form of receipt on payment, the counterfoils of the receipt being checked with the duplicates of the carbon invoice book. The daily total of the cash sales will be entered in the cash book in the particular column provided for that purpose, posted to the credit of the cash sales account in the Nominal Ledger, and the totals periodically posted to the credit of the stock account.

The ordinary credit sales book, which will contain brief particulars of each dispatch of goods, is of varying design, but the following is submitted :—

Date.	Ledger folio.	Name.	Particulars of dispatch.	Particulars of goods.	Weight or quality.	Price.	Amount.	Total.	Charges thereon. Frt. and primage.	Insurance.	Cust'ms entry and clear'nce.	B/Lading.	Consular invoices.	Cases.	Dock charges.	Total

A systematic record of articles sent out on approbation with the expectation of eventual purchase, and if not purchased, of their return, should be, of course, kept. Such issues must not be treated as sales until the purchaser has definitely signified his intention of purchase or fails to return the articles sent him.

Testing.—All completed articles should be carefully examined and tested before being dispatched, so as to ensure or merit the complete approval and satisfaction of the purchaser, and the time spent thereon should be allocated as part of the cost of the article tested where it is of an appreciable amount.

Packing.—Should there be a packing department, all packing stores and materials should be debited to that department, the cost of the manufacture of packing cases, &c., being made up as follows :—

Materials and stores.
Wages.

These form the prime cost of the boxes, crates, and so on made, and they will be charged to packing stock. When issued they are charged to the particular work or contract at cost.

Travellers' Salaries and Commissions.—Both personal and nominal ledger accounts should be raised from these charges, which will be supported by proper statements, the items forming part of the expenses of distribution.

Catalogue Prices.—In fixing catalogue prices, and prices for the trade, much care is required. For example, let us

assume the manufacture for stock of a certain article, the cost of which is, say, 40s., and that it is proposed to make a profit of 25 per cent. on the selling price, and allow the trade 20 per cent. and 2½ per cent. for cash.

The trade price is £3 8s. 5d., which may be demonstrated as below :—

Trade price			£3 8 5
Deduct 20 per cent.			13 8
			£2 14 9
Deduct 2½ per cent.			1 5
Net amount of invoice			£2 13 4
Cost as above	£2	0 0	
Profit on selling price		13 4	
	£2	13 4	

As we have seen, the materials and stores are charged to materials and stores stock account in the first instance, all issues therefrom being appropriated to the proper contracts and accounts. Similarly with wages. Railway carriage, freights, duties, and other similar expenses, are sometimes troublesome. They may be divided into—

(*a*) Carriage on materials and stores purchased.
(*b*) Carriage on sales.
(*c*) Carriage on finished articles purchased.

(*a*) The proper course is to add the cost to that of the purchases, and provision should be made in the stores ledgers accordingly. Sometimes a carriage and freights account is opened, and all such charges are debited thereto, a proportion being charged to the work finished during, and in progress at the end of, the year, the balance carried forward to be spread over the work done during the following year and so on.

(*b*) An account may be opened for carriages, freights, and other shipping charges payable by the company on goods dispatched, the total, less any proportion chargeable to customers, being transferred at the end of the year to the distribution account.

(*c*) In this case the cost of carriage and so on should be added to the cost of the finished articles purchased, and the finished stock account should be so framed as to attain that object.

A production cost account should be opened in the nominal ledger with subsidiary titles for columns for the record of the various charges incurred, and similarly in regard to the inauguration of distribution cost and administration cost accounts.

Below is a ruling showing the *pro forma* entries in respect of a contract in progress at the end of the financial year and in its completed state.

Frequently questions arise as to what proportion of profit, if any, in respect of contracts in progress at the close of the financial year, should be taken to the credit of revenue. In practice, these questions can only be determined equitably after full consideration of the progress made and the precise condition of the works at the period.

THE STATUS OF AN ELECTRICAL ENGINEER.

[BY OUR LEGAL CONTRIBUTOR.]

The question often arises in the mind—Who is entitled to call himself an electrical engineer? Walk along any street and you will see that the title is adopted by everyone who sell lamps and fittings. Send for a man to put the bells right, and a gentleman will turn up who calls himself an electrical engineer. Pass down Victoria Street to seek a man who is to act in connection with a job costing a million of money—you will find that he is content to use the same description, though possibly he may prefer to be called a consulting engineer. That leads us off on another trail—anyone may call himself a consulting engineer if he is so minded. The truth is that the profession which this journal represents has no control over this matter. The heads of that profession, by precept and example, may have created a certain standard of professional honour and etiquette—a standard which is honoured and respected by all who are justified in using the title electrical engineer in its wider sense; but the profession as a whole has no sanction to enforce that discipline by legal process.

In this respect the allied bodies of engineers and electrical engineers are less favoured by the Legislature than the other professions. Doctors, dentists and veterinary surgeons can protect themselves, and—what is more important—can protect the public against the use of misleading titles. No man can call himself a doctor, or a dentist, or a veterinary surgeon unless he is qualified; nor can he put after his name any letters calculated to induce the belief that he has a qualification. Let us glance, for a moment, at a case relating to a dentist which was heard recently in the King's Bench Division. A man had been convicted and fined for passing himself off as a qualified dentist. The following notice appeared over his door (after his name): "Finest artificial teeth at moderate prices, extractions. Advice free, hours, 10—7, English and American teeth, advice free, painless extractions." The British Dental Association took the matter up. A clerk in the employment of their solicitors

Contract and Works Ledger.

Dr. Order A 179. Wm. Robertson & Co., Ltd. Cr.

Date.	Folio.	Particulars.	Stores.	Wages.	Finished stock.	Inward carriage.	Production charges.	Distribution charges.	Administration charges.	Total.	Date.	Folio.	Particulars.	Amount.	Total.
1906.			£	£	£	£	£	£	£	£	1907.				£
Dec. 31		†	270	300	25	3	2	2	3	605	Nov. 4		W. R. & Co.	§	200
		Trading account‡								120	Dec. 31				525
		Balance...								725			Balance		725
										525					
1907															
Jan. 1			200	390	10	2	3	6	5	616	Jan. 6		W. R. & Co.		300
Dec. 31		Trading account								229	Jan. 28		"		1,070
			470	690	35	5	5	8	8	1,370					1,370

	Dr.	Cr.	
† A journal entry order A 179 to	£605 0 0		
SUNDRIES.			
Materials and stores account		£270 0 0	from allocation of materials and stores issued.
Wages account		300 0 0	" allocation of wages.
Finished stock account		25 0 0	" issues of finished stock.
Inward carriage account		3 0 0	" appropriation for inward carriage account.
Production charges		2 0 0	" " " production charges account.
Distribution charges		2 0 0	" " " distribution charges account.
Administration charges		3 0 0	" " " administration charges account.

‡ Trading account is credited with the profit taken or realised and the particular contract debited.
§ As amounts fall due, they are, of course, credited to the particular contract and debited to the personal account.

attended at this gentleman's place and had a tooth treated. A prosecution was then launched under Sec. 3 of the Dentists' Act, 1878, which provides that a person shall not be entitled to take or use the name or title of dentist (either alone or in combination with any other word or words) or of dental practitioner, or any name, title, addition or description implying that he is registered under this Act, or that he is a person specially qualified to practise dentistry, unless he is registered under the Act. The magistrate having found that the defendant, by using the words "painless extraction," had held himself out as a person possessing the highest degree of skill, he was convicted, and the conviction was upheld on appeal.

The importance of this case lies in the fact that the defendant was convicted—not because he used a title which implied that he had a legal qualification to practise as a dentist, but because he used a description which implied that he was qualified in the popular sense of the term. He was punished because he held himself out as a person skilled in the art of dentistry.

Unfortunately it is not given to the Institution of Electrical Engineers to protect the public in like fashion against those who hold themselves out as electrical engineers. No doubt a man could be prevented from using the letters "M.I.E.E." or "A.M.I.E.E."—just as an unqualified accountant can be prevented from proclaiming to the world that he is a member of the Society of Chartered Accountants. But there is nothing to prevent any unqualified person describing himself as an electrical engineer or as a consulting electrical engineer. Perhaps the time may come when the Legislature will give attention to this matter. It is true that intelligent people are not misled—nor, for the matter of that, is the thinking portion of the population deceived by the quack doctor or dentist. Nevertheless, from the point of view of public safety, it is a grave question whether unskilled persons should be allowed to pretend to a knowledge of dangerous machinery and apparatus which they do not possess. The use of electricity in all its varied applications has become interwoven with industrial and domestic life. As the law now stands, the man who pretends to be a veterinary surgeon may be punished if he comes to attend on a sick cow, while the man who pretends to be an electrical engineer may play havoc with a private installation, and yet continue to deceive the public into believing that he is a skilled person.

BRAKES FOR TRAMCARS.

Abstract of Report of the Special Committee Appointed by the Municipal Tramways Association.

Note by the Executive Committee.

Shortly after the appointment of the Committee, a letter was received from the Tramways and Light Railways Association, intimating that they also had appointed a Committee to deal with the matter, and it was decided, after several communications had passed between the two Associations, and after the Board of Trade had been consulted on the subject, that each Committee should pursue its investigations separately, and when the investigations were approaching completion, joint conferences should be arranged, with a view, if possible, of arriving at some common conclusions on the matter. Communications were made, when the Report was in draft, with the Board of Trade and the Tramways and Light Railways Association, with the result that a joint conference of the two Brakes Committees was held at the Board of Trade offices on October 30th, 1908. Col. Yorke pointed out that the object of the joint meeting was to consider as to the best manner in which the reports of the two Committees could be best combined, so as to form a useful book of reference for the use of the tramway world hereafter, and he suggested that the two Committees should form themselves into one and draw up a short report embodying their joint conclusions and recommendations. These conclusions and recommendations could then be issued along with the two reports in one volume, and they would become a standard authority upon the brakes question for many years to come, and form a basis upon which the Board of Trade would be able to frame their regulations and requirements.

Mr. Fell, on behalf of the Municipal Tramways Association, expressed entire agreement with this suggestion, and stated that the Association were willing to do everything in their power to assist the Board of Trade in this matter.

Mr. Sellon, on behalf of the Tramways and Light Railways Association, however, said they were unable to agree to the proposal, and that they had already decided to publish their report at once as a separate document.

Col. Yorke expressed his regret at the unsatisfactory termination of the proceedings.

The Executive Committee requested the Brakes Committee to see Col. Yorke again, and to inform him that the Association had decided to pursue their investigations, with the assistance of Mr. Fell, who was a prominent member of the Light Railways Association Brakes Committee, with a view of clearing up, by further experiments, certain points of divergence in the two reports, and with the object, if possible, of arriving at some general conclusion which would be valuable to the Board of Trade in the framing of their future Regulations. The Brakes Committee accordingly saw Col. Yorke, who expressed his entire agreement with the proposal.

Report of the Special Committee.

The Committee have held a considerable number of meetings, and representatives have visited various cities and towns where special types of brakes are in use or are being experimented with, and in addition to this they have addressed inquiries to 76 municipal tramway managers, and obtained their views on the subject of brakes generally, and more particularly the results of experiments with brakes, sand gears, and allied apparatus not in general use.

The Committee submit that the general conclusion to be deduced from this evidence is that the accidents, taken as a whole, have been due rather to the failure of the human element than to the failure of the brakes, and they think they are justified in going so far as to say that, with reasonable skill and care, the ordinary brake equipments which have been approved by the Board of Trade have, generally speaking, shown themselves equal to the work they have been called upon to perform. Taking all the tramway accidents which have called for local inquiry by the Board of Trade during the past six years, the Committee find that the fatalities in connection with such accidents, if compared with the total number of passengers carried, work out at one per 182,875,000.

The Committee, however, fully realise that these accidents having taken place, a natural duty devolves on tramway operators to carefully consider means whereby the risk in future may be reduced. The Committee have given consideration to what they believe may be the causes which are likely to result or have resulted in runaway cars, and submit the following as embracing their views on the subject:—

1. The careless or thoughtless breaking or ignoring of important regulations.

2. The growing tendency to construct and work tramways on very steep gradients, and the running of cars on these gradients at too high a speed. The safe operation of a gradient of one in nine or steeper depends absolutely on the surface of the rails being kept clean and free from grease; also on the fixing of low maximum speeds for gradients of this character, and careful supervision to ensure that these speeds are never exceeded.

3. The employment of men who are not from various causes fit for their position, and the insufficient amount of training and testing of men in charge of cars. No man ought to be appointed a driver of an electric tramcar who has not first passed a careful medical examination. A rigid and careful examination as to fitness in handling a car should be made by a responsible officer after the man has been thoroughly trained in his duties. Periodical testing (medical and practical) of men is a necessity of safety.

4. The danger of adopting new forms of brakes without the fullest knowledge as to their action under all conceivable conditions of service.

5. The disregard of the absolute necessity of constant and careful inspection in the depôts of all brakes and equipment generally, and the danger of allowing cars which have exhibited defects to remain in service on the road when they should have been sent to the depôt.

6. The running of cars on long gradients without suitable track brakes.

7. Drivers of cars losing conscious control of their actions under trying and critical conditions. The cause of panic on the part of a car driver, in practically every case, is due to the occurrence of some unusual phenomenon in connection with the working of the controlling apparatus under his charge, and panic having once taken possession of a man, it is impossible to say what his actions will be. To reduce this risk involves the designing of a brake where the minimum of skill on the part of the driver is required, and of such constructional design as to win the absolute confidence of the man whose duty it is to operate it.

A necessary quality in an ideal brake is that its application to the fullest possible extent does not involve its failure under any circumstances, obviously meaning that the danger resulting from skidding wheels shall not exist. Simplification of braking apparatus is desirable. All brakes, however, no matter how simple, are subject to failure of some description. Two alternative methods have been suggested for reducing the risks to a minimum, namely:—

1. To have more than one brake per vehicle, each quite independent in action, so that in the event of failure of one, the other brake, or brakes, could be called in to use.

2. To have only one brake per vehicle, but so designed that in the event of failure in the ordinary method of application, the brake would be automatically applied, and not released.

The first method is the one which has been generally adopted, but the second method, if realisable in the fullest degree, seems desirable, and the Committee suggest that an ideal brake equipment would be one where the same gear is used for all purposes, viz., service, emergency, and coasting, and worked from a single lever by the driver; the only difference between easy service stops and quick emergency stops, would be one of degree of application, and in the event of failure or accident, the result would be the application of the brake, and not its release. An ideal brake would also be one that could be operated at any time by the con-

ductor of the car, and be equally effective whether the car was running forward or backward. It should, as far as possible, be independent of auxiliaries (sand, &c.).

The Committee realise that they are speaking of ideals only, and that their absolute attainment may be impossible, but they may give a lead to inventive minds, and mark out the path of progress.

It has often been stated, and generally agreed, that, inasmuch as the conditions on different systems vary, a universal type or system of brakes is not only impossible, but undesirable, and that whilst a certain type of brake may be excellent for one system, it is not necessarily good for another where the conditions are different. The Committee, however, are not prepared to admit the correctness of this view. Not many systems are so flat that they have not a gradient sufficiently steep to require special apparatus and precautions. On the other hand, all systems require quick-acting brakes to avoid street collisions with other vehicles. This being so, the Committee suggest that tramway conditions are, speaking generally, of a standard character, and are, therefore, open to standard treatment.

The following types of brake equipment have been generally adopted in this country in accordance with the requirements of the Board of Trade, viz.:—

1. *Wheel Brakes.*—The design of this brake is practically standard. Apart from the difficulty inseparable from the principle of action, viz., the skidding wheel, it has proved an excellent piece of apparatus. The winding up of a chain on the brake spindle, though somewhat severely criticised by Col. Yorke, has not given much trouble in practice. The Committee are unable to agree with the remarks of Col. Yorke in his report on the Highgate accident relative to the question of the proper position of brake blocks on the wheels, nor are they able to agree with his observations as to the requisite amount of clearance between the blocks and the wheels, and the necessity of grinding or surfacing brake blocks in a special machine before being used.

2. *Electric Brakes used for Emergency Purposes.*—The objection to this type of brake is that at times of emergency the car driver, accustomed as he is to use his wheel-brake for ordinary service stops, involuntarily tends to put on such brake harder; he thus locks the wheels and renders inoperative the rheostatic brake.

3. *Track or Slipper Brakes.*—On tramway systems with gradients of 1 in 15, or less, the cars are, by the Board of Trade Regulations, required to be equipped with track or slipper brakes.

(*a*) *Mechanical Track Brakes.*—The mode of operation is generally to apply this auxiliary brake sufficiently hard when descending steep gradients to supply the necessary retarding force to balance the gravity forces. This form of brake has proved very effective in the operation of tramways on steep gradients; it is approaching the ideal brake on account of the fact that it is not liable to failure when applied to its maximum extent, also because of its non-liability to get out of order. Notwithstanding the transference of weight from wheels to track shoes, its effect is to materially lessen the tendency of the skidding wheel on account of the cleaning action of the shoe on the rail. An advantage in this type of brake is gained by multiplying the points of application, thus utilising the weight of the car at four points instead of two. As a result of experience and tests with this type of slipper brake, it has been found that, on a greasy rail, cast-iron blocks are more effective than wood blocks, whilst, on a dry rail, wood blocks are more effective than cast-iron blocks. (See test sheets.) It main disadvantages are that it is slow in application, and its effectiveness is limited to the available weight of the car.

(*b*) *Magnetic Track Brakes.*—Theoretically, the utilisation of a magnetic brake-shoe, properly designed and proportioned, should be excellent both for service and emergency braking; its operation is of necessity economical when compared with other forms of power brakes, as it utilises the waste energy primarily obtained from the momentum of the moving car. Further, owing to its magnetic properties, its effectiveness is not limited to the weight of the car. When the car is travelling at a speed in excess of 4 or 5 miles per hour, it is practically instantaneous in its action. Disadvantages of purely magnetic brakes are, unfortunately, serious. They are not simple brakes, their operation depending upon the correct working of a number of the more delicate portions of the car equipment, which are consequently liable to derangement at inopportune times. It is impossible for the driver to tell whether the brake is available for action or not until his car is under way.

(*c*) *Combined Mechanical and Magnetic Track Brakes.*—Recent developments have been in the direction of combining the best features of both the mechanical and magnetic track brakes. For coasting purposes these brakes can be applied mechanically while the car is at a standstill before commencing the descent of a gradient, and the speed may be regulated by gradually increasing the pressure of the blocks mechanically or by magnetism. Either form of application is sufficient to control the car without the assistance of the wheel brake, thus eliminating the danger of the skidding wheel or the uncertainty of the magnetic brake acting, through failure of the electrical equipment.

Power for Brake Application.—The speed of application (and manipulation) of any brake is necessarily vital to its effectiveness. This result may be accomplished by the use of power. The most common form is compressed air, and the Committee are impressed with its effectiveness where they have seen it in use, although, in common with other forms of power brakes, it is more complex than a purely mechanical brake. In the United States and the Continent, air brakes are almost universally used; but so are trailer cars, and the use of these trailer cars almost compels the adoption of an air or similar brake equipment. The problem for unit vehicle control is not quite the same, and it is conceivable that manually-operated brakes may be improved to achieve the results already accomplished by the power-applied brakes—that is, so far as quick application and manipulation are concerned.

Run-back Preventers.—The Committee are of opinion that cars operating on gradients should be equipped with run-back preventers, which should act automatically.

Galton, in his paper read before the Institute of Mechanical Engineers (October, 1878), stated:—

"The efficiency of a brake depends upon the pressure being proportioned to the speed and to the adhesion. At present no means are in use by which the pressure (on the brake blocks) can be regulated with due regard to the adhesion, beyond those dependent on the judgment of the engine driver. There is, however, no reason why, in the progress of mechanical science, both the above conditions should not be regulated by a self-acting arrangement."

So far as the committee are aware, no such device as mentioned by Galton has been adopted by railways or tramways, but even if such were the case, the greasy rail difficulty would still exist, though skidding might be impossible. Conceivably, adhesion would get so low that control on steep gradients now common on many tramways, would be either impossible, or very poor without the use of sand, &c. In the discussion on Galton's paper, many interesting theories were advanced as to why the coefficient of friction fell off between the wheel and the block when the relative velocities were increased, for that phenomenon did not quite agree with accepted friction laws, *i.e.*, that the frictional value of two substances in contact is independent of their relative velocity. It is not, therefore, a foregone conclusion that this phenomenon would exist under all conditions, and there is considerable room for investigation and research work in this direction.

Several experiments have been made on behalf of the Committee, the results of which are appended to the Report, the object being to throw some light on this important point.

In one experiment (Appendix N) two ordinary tramcar steel-tired wheels were mounted on their axle and fixed in suitable bearings and driven by an electric motor at varying speeds. A weighted cast-iron brake block was held against the periphery of a wheel, and the tangential pull recorded on a dynamometer. The wheel was running in a trough of water, and was thus kept cool, and to some extent lubricated. The speed was varied from nil to 20 miles per hour, and the tangential pull was seen to be practically constant throughout, with the exception of the static pull at starting.

Another experiment was made by mounting a tramcar truck on cast-iron shoes instead of wheels, and attached to the drawbar of a tramcar through a dynamometer. The truck was pulled along the tramway at various speeds on various rails, and whilst some falling off of the frictional value certainly took place, yet an examination of the tables and plotted curves appended, clearly shows that there is a tendency towards constancy when the speeds approached 13 to 16 miles per hour. These curves also show the beneficial cleaning effect of the shoes as shown by the increased frictional value of each run, and particularly so when the rails had been watered and cleaned. (Appendices E and M.)

The above-mentioned experiments are quite in keeping with the observed results of every-day practice, and prove conclusively, that the chief benefit of a track brake is that it automatically cleans the track, and therefore increases the effectiveness both of itself and the wheel-brake. Where metal track brake shoes are in use, their effectiveness is much increased by a wet rail, and even on a greasy rail they are much more effective than on a dry dirty rail.

Summary and Conclusions.

At the root of the brake problem, and the problem of the prevention of tramway accidents generally, two factors stand out prominently, and continually force themselves to the front for consideration, no matter from what standpoint the subject is approached. These are:—

1. The weakness of the human element, that ultimate element necessary for the safe operation of cars—no matter how perfect the brakes may be.

2. The greasy rail, and the consequent danger of the skidding wheel.

The Committee think they are justified in saying that the human element has been the chief cause of most serious tramway accidents, and they trust that the fullest consideration will be given by tramway authorities and the Board of Trade to the suggestion contained in this report, as to the selection, training, and control of tramway employés and staff. Improvements in tramcar brakes should be largely in the direction of reducing the importance of the human element, and should follow the lines set forth by the Committee in their suggestions as to ideal braking apparatus.

Control of cars by purely mechanical means, without sand, &c., is possible on steep gradients at reasonable speeds on practically clean rails; but with greasy rails, such as are common in all towns, proper control is impossible without the use of (*a*) sand, &c., for increasing the adhesion; or (*b*) magnetism for increasing the downward pressure on the rails in excess of the weight of the car. The Committee feel that the safety of passengers when descending steep gradients should not depend on the safe working of a sand-box and gear, and magnetic arrangements alone are as yet not sufficiently reliable to be entirely depended upon.

The brake problem therefore resolves itself largely into a question of track cleaning—the keeping of the rails free from greasy matter.

The remarkable effectiveness of track brake shoes for cleaning purposes makes that system the most reliable for safely negotiating gradients. Serrated cast-iron shoes are better than smooth cast-iron, and taking the average of track conditions—wet, dry and greasy—cast-iron is better than wood. It will be noted on the test sheets appended to the Report, that on dry rails the friction

coefficient of cast-iron is much lower than that of wood, therefore increased leverage may be required in the case of iron.

The maximum safe pressure possible on track shoes depends much on the type of track brake. With flanged blocks, and the weight of the car taken on a steady base, the pressure could be a high percentage of the total car weight, but where the weight is taken midway between the axles, the pressure should not exceed 40 per cent. of the weight.

The danger of the skidding wheel led the Committee to consider whether it would be desirable to dispense with the wheel-brake, but they cannot recommend this course, as wheel brakes, under good conditions, are most effective.

The practical result of the Committee's deliberations is that a brake which can be applied instantaneously either by hand or power from a single lever to both rails and wheels is desirable, and one so designed that the track shoes take the full allowed percentage of the car weight before the wheel brake comes into operation. One of the most important effects of track-brake shoes is to clean the rails, and they practically obviate the necessity for the use of sand, which is most desirable.

The Committee are quite in accord with the views expressed by Col. Yorke as to the undesirability of an independent brake for purely emergency purposes, and they agree with him, also, as to the advantage, for braking purposes, of steel tires, as against chilled iron.

So long as sanding apparatus is necessary, it should be of good mechanical design, and so arranged that both rails are sanded simultaneously, and that the driver should be able to apply sand at the rear end from his platform.

PROCEEDINGS OF INSTITUTIONS.

Transformers: Some Theoretical and Practical Considerations.

By A. P. M. Fleming and K. M. Faye-Hansen.

(*For abstract of paper see* Electrical Review, *p.* 1005.)

Discussion.

Mr. J. S. Peck said that whilst theoretical considerations gave a certain amount of information, the questions of easy repairs, easy ventilation, cooling and many other points had to do with the choice of type, rather than mere cost. The cost of labour could not be put into any formula. As regarded explosion, there was no danger from the oil itself. It had become the practice to specify 150 lb. internal test pressure.

Dr. C. C. Garrard said that in dealing with the theoretical portion of the paper, he found himself to be in complete agreement with the conclusions arrived at by the authors. As regarded, however, the methods by which the authors had arrived at their conclusions, he was not able to agree with them to the same extent. He thought that in such matters one arrived at one's conclusions as a result of experience, and then set to work to find a nice theoretical proof to demonstrate that what one knew to be true was true. He had found that it was a great advantage often to use a varying magnetic induction, greater in the core and lesser in the yokes; this resulted in a lesser length of mean turn. The authors had assumed that the ratio between the cost per lb. of copper and iron respectively was 3; but taking transformer iron at 1·7d. per lb., and copper at 10d., one obtained a ratio of 6. He pointed out the importance in modern transformer design of low reactance. The resulting large forces on short-circuit could easily be allowed for, and need not be taken as a reason for not calling for close regulation. For good regulation greater sub-division of the winding was necessary with the shell type of transformers than with the core type, a matter of special importance if earth shields between the primary and secondary were called for. Earth shields were about the last things that should be placed in a transformer; they must of necessity weaken the insulation, and their efficiency was extremely problematical. The chief difficulty in the design of transformers, except with the smallest sizes, was temperature rise. With oil-cooled transformers it was generally sufficient to measure the temperature rise at the upper surface of the oil; with air-cooled transformers the matter was much more difficult, owing to the unreliability of thermometer measurements. This applied especially to the circular shell type of transformer. Experiments that he had carried out on such transformers showed that under working conditions a very great temperature gradient existed from the middle to the exterior of the transformer. Thermometer measurements on such transformers were useless. With the core type of transformer, however, thermometer measurements were much more reliable, as a thermometer could be pushed down between the coils, and between the coils and core. The only method by which the correct temperature rise of a circular shell type of transformer could be obtained was by determining the increase of resistance of the winding. He had found indications of dielectric loss of nergy, but only on very high-voltage transformers, of the order of 0,000 volts. He doubted very much whether the method of using lternate layers of metal foil and insulation for terminal insulation was of practical value. With regard to explosion, no danger was to be expected from the oil itself; there was a danger of explosion, however, common to all transformers in tanks, whether of the oil-cooled or air type, due to the explosive mixture formed by the vapour of the solvent of the insulating varnish and air. Most of the good modern insulating varnishes used in transformer construction consisted of linseed oil or other substances dissolved in benzine or naphtha. If, after impregnation, the transformers were not subjected to a prolonged drying to drive off the solvent, this would escape and accumulate in the tank, and could be exploded if a light were brought near any opening in the lid of the tank, provided the tank had not been ventilated after taking the cover off the opening.

Mr. G. Harlow said there were some practical reasons which favoured the adoption of the rectangular shell type of transformer for certain conditions of operation, since, as the manufacture was cheaper, more material could be put in the transformer for the same price, with correspondingly higher efficiency, or for the same efficiency a cheaper transformer could be built. Working at the same induction in all the transformers, the shell types would have only 60 per cent. of the number of turns of the core transformers; thus the labour to be expended on winding was cheaper with the shell transformers, and this advantage was particularly noticeable on small transformers where the number of turns was large, particularly in H.T. transformers of all outputs. A further advantage of the rectangular shell transformer in connection with H.T. work was the ease with which series-parallel connections could be made. Often on H.T. transformers (above 30,000 volts) series-parallel connections were required, in order that the range of voltage might be great, and with the circular core type of construction it was necessary to bring these connections up to the terminals from a position in which they passed adjacent to other parts of the winding at a wide difference of potential to themselves. In the rectangular shell transformer, all the leads might be brought out at the top of the transformer and connected to a terminal board mounted immediately above them, thus avoiding all crossing of leads. Further, the shell transformer could be much more easily braced to withstand the tremendous forces which occurred on short-circuit. There need be no bolts through the magnetic core, and consequently the building of the iron circuit was much cheaper and the probability of humming much reduced. The introduction of alloyed sheet-steel had reduced the cost of the active material 35 per cent. for the same efficiency and output. But though that reduction could be obtained for the present standard efficiencies given by the various makers of repute for transformers built with normal iron (*i.e.*, having a loss of 1·5 watts per lb. at 50 periods, 10,000 lines per cm^2.), this reduction in price was not possible for transformers having a lower periodicity than approximately 30. Below that periodicity, it was not possible to increase the induction as at present used in low periodicity transformers, owing to the excessive no-load current which resulted from any increase in this induction. Consequently what might be expected and was obtained in low-periodicity transformers was a considerable increase in efficiency but very little reduction in price. The crying need of transformer builders at the present time was for an iron having the same losses as the new alloys but having a much higher permeability, since unfortunately the new alloys were not any better in this respect than the normal iron used up to the time of their introduction.

Mr. J. Faith thought that one type might be the best for the small transformer and another for the large transformer.

Mr Fleming, in reply, said that a good many makers stuck to the type of transformer they first commenced to build on the score of cost. All manufacturers of transformers were in agreement with regard to temperature rise.

A Comparison of Natural and Induced Draught Systems.

By W. N. Y. King.

(*For abstract of paper see* Electrical Review, page 1003.)

Discussion.

Mr. J. R. Williams said that with natural draught the weight of gases discharged would be found to attain its maximum at about 600° F., and gradually diminished for higher temperatures; at the same time the weight of hot gases discharged per second varied very little within the wide limits of temperature of 300° to 1,000° F. Practically nothing was to be gained in quantity of air supplied to the furnace, by carrying the temperature of the waste gases in the chimney higher than 400° F. It was hardly fair to compare a brick chimney costing £1,000 with a useful life of 75 to 100 years with an induced-draught plant, whose approximate useful life was from 10 to 15 years. A better comparison would be with a natural-draught plant with a steel chimney; this could be erected to a height of 200 ft., and by the use of foundation bolts and guy ropes, the foundation need not be more than 1½ times the area of the chimney itself. It was no more necessary to use an internal brick lining for natural draught than for forced or induced draught, and the cost of a chimney of this type would be approximately £300, and would, therefore, show a much greater economy for the natural-draught plant than was given in the paper. The best position for fixing the guys was not at the top of the chimney but at approximately two-thirds of the chimney height. In his opinion the ideal method would be to have all boilers discharging into one main flue, the gases passing through economisers and one large fan at the chimney base arranged with two motors for the sake of reliability; for ordinary loads the natural draught could be utilised, and the fan would be brought into service for peak loads.

Mr. Graham said that where two 7 ft. × 30 ft. Lancashire boilers were working in conjunction with three others, his firm guaranteed to give more steam out of a 9 ft. × 30 ft. boiler fitted with the Ellis and Eaves air-heating system and induced draught than they were getting from the two old boilers. They were enabled to get about double the steam from this one boiler, and at the same time to

effect a saving of about 70 per cent. in fuel. The two boilers were working under exceedingly bad conditions. In another case where three Lancashire boilers were working together under natural draught with a chimney 100 ft. high, and were found inadequate, they guaranteed to get sufficient steam from two of the boilers and give an economy in fuel of 20 per cent. This they did quite easily. In the case of a large water-tube boiler, the normal rating of which was 30,000 lb. of steam under natural draught, on actual test with induced draught and a combination of the Ellis-Eaves system of hot air the evaporation was 52,000 lb. of steam, and even at that high evaporation the efficiency of the boiler plant was 82 per cent. With an induced-draught plant alone they would get an increased evaporation from boilers, but he considered that this was acquired at the expense of economy. In putting down an induced-draught plant he would always recommend that either a feed-water economiser or an air-heating economiser should be installed as well, for the reason that when working the plant during the peak load, there was no doubt that at the higher rate of combustion there was more waste than with the ordinary chimney draught. An air-heating economiser would give more economical results than a feed-water economiser. The effect of introducing hot-air to the fires was this; for every degree of heat extracted from the waste gases and returned to the fires in the shape of hot air, the temperature of the furnace was increased nearly 2°. If they put air into the furnace at 300° F. the resultant increase in temperature would probably be about 500°. This was due to the fact that the furnace temperature was kept up. In getting out estimates they found, especially if the installation were a large one, that the first cost of an installation of boilers and induced draught with hot-air economisers was less than that of the requisite number of boilers to give the same evaporation with a natural-draught chimney. They had just patented a combination of forced and induced draught, with fans of such proportion that the vacuum set up by the suction fan was just sufficient to overcome the resistance in the boiler flues due to the pressure set up by the pressure fan forcing air into the furnace. The result was that they could burn the same amount of coal per sq. ft. of grate with less than 1¼ in. of suction and 1 in. of pressure where an ordinary induced-draught furnace would require 2½ in. With a very high suction at the fan the amount of air drawn in through possible leakages in the brickwork was considerable.

Mr. W. B. Woodhouse said that in a fair comparison one must not merely include the capital cost of the chimney on the one side and the fan on the other, but also the capital cost of the economisers that were put in, or take the capital expenditure on the whole boiler-house plant in the two cases. In Table C, assuming that a good coal was used with a thermal value of, say, 14,500 units to the pound, that gave a boiler efficiency of 80 per cent. From the given percentage of CO_2 in the gases there was a loss due to imperfect combustion of 12 per cent., and Mr. King gave a further loss due to the heat taken away by the gases of 13½ per cent., consequently the heat balance-sheet did not balance.

Mr. King said it was not 14,500, but about 12,800.

Mr. Woodhouse replied that in that case the results were impossible. All calculations which dealt with the efficiency of boilers were apt to be misleading unless the efficiency of the furnace and the efficiency of the boiler as a heat transferring apparatus were treated separately. The efficiency of the boiler as a means of getting heat from the gases into the water did not vary very much with the amount of water evaporated per sq. ft. The efficiency of the furnace, however, would vary very closely with the draught, but depended on other things besides the draught. His own experience had been that a draught of 1 in. or more enabled one to handle the fires very much better, and frequently to get increased output from the boilers. The control which one secured over combustion by a means of varying the draught was a most valuable aid to efficiency. He was very much in agreement with Mr. King regarding induced draught. In one case they were working with a chimney that was too small, but by putting in an induced-draught fan it increased the output of the boilers by 25 per cent.

Mr. R. H. Campion said that a natural-draught plant on modern lines had expanding flues, thus doing away with half the shaft traps. In the majority of cases where induced-draught plant had been installed, which had come under his notice, it had been to overcome the inherent bad design. The steel chimney on the London United Tramways was very substantially made, and he thought it would be quite safe to put the life of it against any brick chimney. In all induced-draught plant the bearings had to be of ample design, or there was a good deal of trouble in keeping them cool. In most large central stations it was advisable to put in an auxiliary chimney in the shape of a small steel chimney, as the cleaning of different portions of the chimney bottom and main flues was a difficult task, whereas if a small auxiliary chimney were installed it would be possible to turn into that whilst the operations were being executed.

Mr. Wilson Hartnell said that if the draught pressure was to be small, the boiler arrangements for maximum evaporative economy must be so designed as to make the resistances to the draught a minimum, leaving as much available draught pressure as possible for the fire. It was, however, much less trouble to manage economically a thick fire with a good draught pressure, with a large —say 150-ft.—chimney. A tall chimney of ample area was an advantage not only as giving rather better results with less trouble, but because it enabled more steam to be raised with a given capital outlay. If it were decided to rely on fan draught, full advantage should be taken of the stronger draught pressure available. The furnace should be such that a deep, intense fire could be maintained, the area of the flues should be such that the gases passed nearer the heating surfaces at a high velocity, and the gases should be cooled as much as economically practicable, and then passed slowly through an ample—but not necessarily high—chimney. If the fire-grate arrangements were suitable for a deep fire, there would be but little loss of evaporative economy if there were not less than, say, 1¼ sq. ft. of heating surface per pound of coal per hour. The thick intense fire required less superfluous air and the furnace temperature was higher. Where reasonable space for ordinary boilers and a chimney was available, chimney-draught pressure was preferable to fan-draught pressure. When the demand for steam was very variable, fans were an economical auxiliary. Fan pressure alone would seem advisable where space was cramped, a sufficient height of chimney not possible, or the demand for steam almost intermittent during long periods.

Mr. H. Dickinson said that for central station work induced-draught fans had considerable advantages. They had installed three fairly large ones, and were running them with motors up to 250 h.p. taking the peak load, and they had found them very satisfactory. They had had very little trouble with the bearings, which were water-jacketed. The plant enabled them to have fewer boilers under steam, and fewer standby boilers, an important factor, and altogether they found very great economy. They had had trouble due to grits with a chimney 210 ft. high, and he thought with a keen draught there would certainly be trouble with a chimney 80 ft. high. In one instance they had scrapers constantly going round in the soot pit of the economiser, carrying these grits into a pit out of the way of the draught, but still a certain amount went up the chimney. In other cases they had dampers arranged so that the grits coming along the flue were driven into a chamber out of the draught.

Mr. King, in reply, said the life of a fan was about 20 years. Changes were constantly taking place in the method of generating electricity, and in 20 years they would be glad to reconsider their decision. If, however, they put up a stack to last 100 years, they would saddle the undertaking with the capital expenditure for the rest of their natural existence, and part of someone else's. A tall self-supporting chimney, even if it were made of steel, must be well splayed out at the base. The brick lining was always put in up to the first 50 ft., if not all the way up the stack. In the case of a short stack, say, about 80 ft. high, projecting from the building a few feet, it was most convenient to put the guys at the top. With regard to the heating of air, with a good brick furnace, similar to those fitted in water-tube boilers, they could get as much heat as the bricks would stand. The repair work on fans was very small indeed. The bottom of the chimney was provided with a door, so that it was a very easy matter to clean out the induced-draught chimney. Another advantage in favour of the induced-draught plant was that they could easily isolate the different sections for cleaning. Since they had had the induced-draught system, they had had no trouble with smoke, providing it was worked properly. When excess air got through, it went through the barer parts of the grate where coal had been consumed to ash, with loss of efficiency owing to the formation of CO, for the air getting in cooled down the gases that were undergoing combustion.

Domestic Electricity Supply (including Heating and Cooking) as Affected by Tariffs.

By W. R. Cooper.

(*Discussion at the* Institution of Electrical Engineers, *Dublin, on Thursday, December 10th*, 1908.)

Mr. W. J. Sowter, in opening the discussion, said the maximum demand system was fast becoming obsolete. Personally, he had found that consumers did not understand the system at all. Any system, to be successful, should be as simple as possible, and the "man in the street" must be able to check his account himself, leaving nothing to be taken for granted. Mr. Sowter did not consider the system of charging by the number of 8-c.p. lamps installed, as advocated by the author, to be any advance whatever. It would lead to endless disputes, and the British public had a very strong objection to domiciliary inspections. What was wanted to make such a system successful was to charge a plant rental depending upon the number of lamps used, as determined by a demand indicator—a system initiated by Mr. Leonard Andrews at Hastings some years ago. Even that, however, brought back some of the evils of the demand indicator system. He thought that the two-rate meter, in spite of its complication, was one of the most equitable systems to adopt. The station peak—at any rate in stations where lighting supply predominated—must always exist, and the two-rate meter encouraged daylight consumption and discouraged consumption on the peak, and these two factors should assist in increasing the load factor. Referring to electrical cooking, he thought that as regarded cost of energy there was little to choose between gas and electricity, but, unfortunately, the cost of the apparatus was so great, and the maintenance costs likely to be so high, that he did not consider station engineers could deal with the matter in the same manner in which the gas companies did: the rental of the stoves, &c., would be too high for them to expect a large demand.

Mr. A. E. Porte agreed that the two-rate meter would prove a satisfactory solution of such a problem as confronted the Richmond Co., judging from the load curves given in the paper. Richmond was a typical residential district, and if the two-rate meters were set to charge twice the price of energy between the hours of, say, 4 and 8 p.m. in the winter, and 8 and 10 p.m. in the summer, they would then get the maximum revenue from the large amount of capital apparently lying idle so many hours per day. He thought that in business towns a large business could be done in radiators for office heating. Offices were notoriously bad lighting consumers, but should be good heating customers, as their demand would not clash with the peak. Mr. Porte described a new

form of electric oven invented by a Dublin gentleman which appeared to him to possess considerable advantages over the ordinary pattern; great attention was given to heat insulation, and he had seen a large ham cooked for a consumption of one unit of electricity, which he thought a distinct advance.

Mr. L. J. Kettle could not agree with the author's figures regarding the cost of energy for cooking. It had been assumed that the load factor of such a demand would be 25 per cent., but it would not be anything like so high. In many towns people were out all day, coming home in the evenings; therefore a great deal of the cooking would be done on the peak of the load. Applying Mr. Cooper's figures with the necessary correction, he had made out an almost hopeless case for electrical cooking. The demand system of charging had done good service in the past, but a flat rate was the more satisfactory one nowadays.

Mr. W. Tatlow thought that there were too many tariffs in vogue altogether, and the one suggested was no advance. People naturally objected to the visits of inspectors, and would also object to paying for light unused when their houses were closed. He did not think there was much extra expense involved in the provision of duplicate circuits for lighting and heating respectively. Houses were not usually so liberally wired that there was sufficient copper to supply radiators and ovens consuming over 1 kw. each. The Corporation (Dublin) always fitted two meters in such cases, which he assumed to be practically equivalent to one larger meter. Mr. Tatlow thought it might be practicable where alternating-current supply was available to introduce cooking apparatus on the induction principle. The main current would pass round a large magnet, and an induced current would occur in suitable conductors embedded in the saucepans, &c., when brought into proximity. Such a system if efficient would result in more commercial apparatus than that at present in use. It would be a long time before the kitchen fire was done away with. In America much heating was done by the supply companies, but it was carried out by their exhaust steam distributed in a suitable manner.

Mr. P. S. Sheardown said that after reviewing existing tariffs, the author proposed another which Mr. Sheardown thought to be open to quite as many objections as any of the previous ones condemned. There was no one tariff that would suit all conditions of supply. As to running separate circuits for power and light, additional copper would have to be put in for radiators, and it would be more economical to run the power circuit separately for the reason that the loss of a volt or two in the power circuit made but little difference. The power circuit should be a very simple matter, run on the tree system, and only need be run over the wainscottings, with plugs supplied where necessary. He considered a double-rate meter preferable to any maximum demand system. The real difficulty in getting consumers for heating was owing to the great expense of electrical apparatus for this work.

Mr. G. F. Pilditch agreed that the proper system was two separate flat tariffs, one for lighting, the other for power, heating and cooking. Restricted-hour systems were apt to defeat their own end; gas companies made no restrictions regarding the use of their commodity, and if electrical undertakings did so their campaign in that direction could not be successful. The cost of wiring was not a serious matter, but he considered it desirable that local authorities should have power to wire up and let out heating and cooking stoves in the same way that their gas friends did. Two-rate meters were costly and complicated; a simple flat rate was the best. Electrical flatirons, although the amount of power they consumed was small, were well used, and should be encouraged.

LEGAL.

W. T. Glover & Co., Ltd, *v.* Mitchell.

At the Dukinfield Police Court on Saturday a charge of attempting to obtain £20 by false pretences from plaintiffs, of Old Trafford, was preferred against Thomas Mitchell, wire worker, Philip's Road, Manchester.

According to the case for the prosecution, on a note-heading of the Central Uruguay Railway Co., Monte Video, South America, the prisoner wrote to Messrs. Glover asking for a tender for cables for South America. A deposit of £20 was required with the tender, and it was requested that it should be addressed to Mr. D. S. Olliver, General Post Office, Dukinfield. Messrs. Glover became suspicious and communicated with the police, and when the prisoner called he was detained.

Prisoner, in reply to the magistrates, said he had never worked for Messrs. Glover, but he had been in America. He said he knew nothing about the letters. He was remanded.

Cuckson *v.* Mexbro' and Swinton Tramways Co., Ltd.

At the Rotherham County Court on the 11th inst., Albert Cuckson, cab proprietor, of Swinton, brought an action against the defendants, claiming £10 10s. for damages caused to a horse, by reason of the defective state of the defendants' tramway track in Rotherham Road, Parkgate.

For the defence, officials, including motormen and conductors of two cars arriving at the place after the horse had fallen, gave evidence, stating that they were unable to find any live studs after applying tests.

His Honour gave a verdict for the plaintiff for the amount claimed.

SILUNDUM: A NEW PRODUCT OF THE ELECTRIC FURNACE.

We are informed that Mr. F. Bolling has succeeded in working out a process, which he has patented, by which it is possible to convert any piece of carbon, in the form of rods, bricks, or crucibles, into silicon carbide. Resistances are thus obtained that will stand temperatures as high as 1,700° C. Silicon carbide had been known previously only in the amorphous or crystalline state, and it was supposed that it was formed by the sublimation of carbon and silicon; Mr. Bolling, however, discovered that silicon would penetrate into carbon when both were in a highly-heated condition. Silicon at about 1,600° C. exists only in the form of vapour, while carbon at this temperature keeps its shape, it being understood that the air has no access to either. Silundum, as the new material has been named, or silicified carbon, is therefore a product that is obtained when carbon is heated in the vapour of silicon.

For the production of this material electric furnaces are used, as for the manufacture of carborundum. Pieces of carbon of suitable shapes are introduced into a mixture of sand and carbon, which is provided with a granular core of coke as conductor for the electric current. Instead of sand and carbon, amorphous carborundum can be used, enriched with sand to provide the necessary silicon to enable the carbon pieces to be converted into silundum.

The silicification of the carbon depends on the time and the temperature employed. It is possible to silicify the carbon pieces entirely, or only to cover them with a layer of silicon carbide of any desired thickness. The carbon leaves the furnace in the same shape as it was introduced, and manufacturing marks impressed on the carbon remain distinctly visible. Tubes of carbon can be silicified inside and outside. Silundum tubes of any thickness of wall or diameter can be made by silicifying a carbon rod, leaving a core of carbon inside that is burned away in a furnace which communicates with the air, thus leaving a tube of silundum. If it is desired that the carbon piece shall remain carbon at one spot, this place is shielded by another piece of carbon, thus preventing the silicon from penetrating into that particular spot. Lamp filaments can be easily converted into silundum, or only covered with a layer of silicon carbide. Charcoal is very easily converted into silundum, and so is coke, because both are very porous. The silicification takes place more easily with porous carbon pieces than with pieces that are pressed very hard and tight, and baked. Graphite is easily silicified. Carbon powder, compressed with very high pressure, can be silicified without first being baked. In order to accelerate the process of silicification, the pieces can be made of carbon and amorphous or crystalline carborundum, bound together with tar or any other bond that contains carbon. This modification may be used in cases where very large pieces are to be converted into silundum. The material at present is produced in a works in Switzerland that was specially erected for the purpose.

Silundum is a form of carborundum, and has similar properties; it is very hard, resists high temperatures, and is acid-proof. It is a conductor of electricity, its resistance being about three times that of carbon. The hardness of silundum is variable, and depends on the zone around the core in which it is produced; material from the amorphous zone is less hard than that obtained in the crystalline zone.

Silundum is fire-proof to a high degree; it can be heated in the air up to 1,600° C. without showing any sign of oxidation. At about 1,700°, however, the silicon leaves the carbon and combines with the oxygen of the air. Small transparent globules are formed on the surface, of clear or brownish colour; these globules are silicon dioxide. Parts of the silicon combine with the oxygen of the air and appear as white vapour. Silundum cannot be melted. The electric resistance of this material depends on the kind of carbon and its hardness; silundum made from porous carbon has a higher resistance than that made of hard carbon. The resistance depends also on the modification of the material; in the amorphous zone the resistance generally is higher than in the crystalline zone.

The first use to which the material was applied was for electric cooking and heating; it was, in fact, for this purpose that the experiments that led to the invention were made.

Electric heating for domestic, as well as for industrial purposes, demands for a large number of appliances a higher temperature than that which can be obtained with ordinary resistance wires. Electric cooking and heating have developed enormously in the last five years, and as electrical energy becomes cheaper, there will be a large demand for electric ranges, that can be used for any cooking utensil, just like a gas range. The electric range demands, however, a concentration of electric power that cannot be obtained at present without over-heating the wires or increasing the weight of the heating plates. Silundum can be used at the high temperature required for the purpose, and thus ranges are produced that have the glowing heat of a coal fire, and are used exactly like those heated by coal.

There is a large demand also for heating apparatus for melting metals and for electric muffles, or high-temperature ovens for laboratories, and it is especially in this connection that the material fills a long-felt want. Silundum can be used at as high a temperature as platinum, and as it is inexpensive, the apparatus is cheap both in first cost and in repair. For heating purposes the silundum rods can be used single, in lengths up to 100 mm., depending on the diameter, as solid, round, flat or square rods or tubes, or in the form of a grid mounted in a frame and provided with contact wires.

Silundum stands the attack of acids just as well as silicon carbide, and experiments are being made with a view to using it for electrodes for electric bleaching.

Silundum is attacked by molten metals, but this should not prevent its use as a fireproof material, for it is easily possible to cover the outside of a carbon or graphite crucible with silundum and leave the inside carbon.

Carbon filaments covered with silundum, and filaments made entirely of silundum, have been tried for use in glow lamps, but it is found that when the filaments are heated in a vacuum the globes are soon covered with a brownish layer of silicon.

Silundum is manufactured at Salop Street Works, Birmingham, by the British Prometheus Co., Ltd., from whom any information regarding the new material may be obtained. We understand that the company are making arrangements to manufacture it on an extensive scale, and hope shortly to be in a position to supply it for incandescent heaters of various types.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AUSTRIA-HUNGARY.—The tariff is divided into two sections known as the maximum and minimum tariffs; the minimum tariff is applicable to countries which have negotiated most-favoured nation treaties with Austria-Hungary, and is therefore applicable to goods of British manufacture. The rates given below are those of the minimum tariff. The statement of the country of origin of the goods on consignment notes, or bills of lading and invoices, is sufficient to secure admission under the minimum tariff. Invoices and consignment notes should state the gross weight of packages and net weight of contents, which should be fully described. When various descriptions of merchandise are packed together, the net weight of each class should be stated separately. The weight of the goods for calculation of duty is the net weight after deducting tare allowances fixed by the Customs, but if desired, the importer may claim the right to pay duty on the actual net weight, except in cases where it would be difficult to ascertain this weight without inconvenience. Krone = 10d.; 100 kg. = 220·4 lb.

	Kronen per 100 kg.
India-rubber or gutta-percha—	
Transmission belts	80
Insulating material of patent sheets, vulcanised or not	100
Fittings for technical and electro-technical purposes for instruments, &c., of hardened india-rubber	115
Fittings for telephone and microphone construction, by permission and under control	90
Fittings, rough pressed of hardened india-rubber, the pressing seams being visible	84
Transmission belts, flat, of leather—	
Of bark tanned leather	58
Of oil dressed or mineral tanned leather	68
Transmission belts of leather, round or cornered, also twisted	80
Transmission cords of cut leather, not rounded, twisted or not	70
Bulbs for electric incandescent lamps	30
Earthenware fittings, for insulation and mounting, for electro-technical purposes, not combined with other materials—	
White	12
Coloured, edged, painted, printed, silvered, gilt	25
Note.—Under insulating fittings and mountings for electro-technical purposes are included, insulating materials, frames, switchboards, contact mechanism, reels, hooks and the like, for electric lighting and for other electrical apparatus, of porcelain, stoneware, majolica or other baked earthenware of all kinds not in combination with other materials.	
Iron wire, coated with tin, zinc, lead, copper, brass, varnished, of a thickness of—	
1·5 mm. or more	14
Less than 1·5 mm. and down to ·5 mm.	17
Less than ·5 mm.	19
Wrought-iron boilers, except those mentioned below—	
Ordinarily worked	20
Finely worked, combined or not with common materials	29
Rails of whatever section, pierced or not, weighing per metre—	
15 kg. or more	6
Less than 15 kg.	7·20
Fastenings for rails; fish-plates, &c.	14
Railway axles and wheel iron, planed, smoothed or not	12
Railway wheels and sets of wheels, finished, with a diameter of—	
36 cm. or more	13
Less than 36 cm.	20
Nickel anodes	14·50
Wire, of copper, nickel, &c., and alloys thereof, rolled, hammered or drawn—	
Over ·5 mm. thickness	19
Over ·25 mm., and up to ·5 mm.	22
·25 mm. or less	26

	Kronen per 100 kg.
Boilers of base metals other than lead, except those mentioned elsewhere	24
Steam boilers, with or without the fittings—	
Of iron, except cooking and distilling apparatus	20
Of iron, with component parts of base metals	30
Of base metals, except cisterns and tanks	32
Locomotives and tenders, and locomobiles (except for agriculture)	29
Steam engines, turbines and other motors not specially mentioned; industrial machinery permanently combined with steam motors (steam dredgers, steam hammers, steam cranes, steam pumps, steam fire engines, and the like), weighing each 200 kg. or less, 40 kr. per 100 kg.; over 200 kg. and up to 2,500 kg., 32 kr. per 100 kg.; over 2,500 kg. and up to 5,000 kg., steam turbines, 26 kr. per 100 kg.; other, 22 kr. per 100 kg.; over 5,000 kg. and up to 10,000 kg., steam turbines, 19 kr. per 100 kg.; other, 22 kr. per 100 kg.; over 10,000 kg. and up to 100,000 kg., steam turbines, 19 kr. per 100 kg.; other, from 10,000 kg. to 50,000 kg., 21 kr. per 100 kg.; from 50,000 kg. to 100,000 kg., 19 kr. per 100 kg.; over 100,000 kg., 18 kr. per 100 kg.	

	Kronen per 100 kg.
Dynamos and electromotors (except motors for automobiles), whether or not permanently combined with mechanical contrivances or apparatus; transformers, alternating or direct current, weighing each—	
25 kg. or less	50
More than 25 and up to 200 kg.	40
More than 200 and up to 500 kg.	32
More than 500 and up to 3,000 kg.	27
More than 3,000 and up to 8,000 kg.	25
More than 8,000 kg.	20
Electric telegraph, ringing, signalling, and railway safety apparatus; telephones and microphones; apparatus for protection from lightning, except lightning conductors; electrical calculating and measuring apparatus; weighing each—	
5 kg. or more	120
Less than 5 kg.—Telephones and microphones, with the lightning guards appertaining thereto	140
Other	200
Switch and contact devices, mounted fuses, and the like, electrical conduction apparatus: all these in holders, boxes, and the like, weighing up to 250 grammes each	150
Electrical lamps (arc, incandescent, and the like)	200
Mounted glasses for electric lights	120
Regulators, resistances, starters, and similar electrical apparatus—	
Weighing less than 5 kg., with mounted electrical registering and measuring apparatus	200
Other, weighing 10 kg. or less	120
Weighing more than 10 and up to 25 kg.	80
„ more than 25 and up to 200 kg.	45
„ more than 200 kg.	30
Accumulators with lead plates, and lead plates for accumulators	36
Electric carbons—Carbons for lighting purposes weighing 1 kg. or less per metre (⅓ oz. per inch)	40
Other	24
Component parts of electrical dynamos and electromotors—Finished, and unmistakably forming parts of such machinery, dutiable as the machinery of which they form part; other, dutiable as "parts of machinery," at rates varying from 15 to 40 kr. per 100 kg.	
Component parts of other electrical apparatus—Finished, and unmistakably forming parts of such apparatus, dutiable as the apparatus of which they form part; other, dutiable as the material of which made.	
Cables and insulated wire—With metal sheathing	48
Without metal sheathing, insulated by means of—	
India-rubber or gutta-percha	70
Textile threads other than silk; also silk combined with india-rubber, gutta-percha, &c.	90
Silk, other, whether combined or not with asbestos, paper, &c.	145
Other materials (paper, asbestos, &c.)	60

Zinc Recovery.—The *Mining Journal* states that an electrolytic process has been invented by an Italian engineer, Signor E. Sanna, for the recovery of zinc from waste. It is said that the process is highly economical, being in a sense regenerative—after passing current from an external source for a time, the current is cut off, and the cell gives a reverse current which deposits a further quantity of zinc! Details of this remarkable process would, no doubt, be interesting; but we fear that it is up against the inflexible law of conservation of energy.

Rand Electric Supply.—A short time ago the news of trouble between the Victoria Falls Power Co. and the Wernher-Beit interests, over the question of electricity supply on the Rand, became public property. Litigation was decided upon. The *Pall Mall Gazette* now understand that recently there has been a resumption of more friendly relations, and that the differences are likely to be composed without any resort to the Law Courts.

NEW PATENTS APPLIED FOR, 1908.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

25,788. "Improved multiple-contact vibrator for ignition, induction, and shocking coils, telephone, telegraph, electric bell and electro-magnetic apparatus." F. J. CLARKE. November 30th.

25,819. "New or improved electric switch." CARDWELL BOORMAN & FORD LLOYD, LTD., and C. STIRLING. November 30th.

25,844. "Improvements in or relating to electric lighting systems, especially applicable to train lighting." J. P. CROUCH and J. ETCHELLS. November 30th.

25,854. "Improvements in the manufacture of electric incandescent filaments from tungsten or other difficultly fusible metal." SIEMENS & HALSKE ACT.-GES. (Date applied for under Sec. 91 of the Act, December 11th, 1907, being date of application in Germany.) November 30th. (Complete.)

25,855. "Improvements relating to magnetic-electric ignition apparatus." The firm, ROBERT BOSCH. (Date applied for under Sec. 91 of the Act, October 31st, 1908, being date of application in Germany.) November 30th. (Complete.)

25,868. "Automatic trembler, particularly applicable to warning apparatus." E. TESTE. November 30th. (Complete.)

25,868. "Improvements relating to the manufacture of coherent conductors suitable for incandescent lamps and other purposes." BRITISH THOMSON-HOUSTON CO., LTD., and T. E. ROBERTSON. November 30th.

25,869. "Improvements relating to the production of coherent conductors suitable for incandescent lamps and other purposes." BRITISH THOMSON-HOUSTON CO., LTD., and T. E. ROBERTSON. November 30th.

25,870. "Improvements relating to the manufacture of coherent conductors suitable for incandescent lamps and other purposes." BRITISH THOMSON-HOUSTON CO., LTD., and T. E. ROBERTSON. November 30th.

25,871. "Improvements relating to the manufacture of coherent conductors suitable for incandescent lamps and other purposes." BRITISH THOMSON-HOUSTON CO., LTD., and T. E. ROBERTSON. November 30th.

25,882. "Improvements in connection with electric light signs." H. I. PALMER. December 1st.

25,899. "Improvements in and connected with the electro-deposition of metals." F. H. BROWN. December 1st.

25,916. "Improvements in electric heaters." C. H. ARCHER, H. J. COATES, and H. HIRST. December 1st.

25,943. "Improvements in and relating to wireless telegraphy and wireless telephony." A. W. SHARMAN. December 1st.

25,954. "Improvements in and relating to magnetic blow-outs." T. VON ZWEIGBERGK. December 1st.

25,955. "Improvements in and relating to magnetic blow-outs." T. VON ZWEIGBERGK. December 1st.

25,957. "Improved electro-motor." I. M. HAWKINS. December 1st.

26,004. "Telephone message holder." E. C. DIGBY. December 2nd.

26,053. "Improvements in aerial electric cables." C. E. EGNER and R. F. FREDRIKSSON. (Date applied for under Sec. 91 of the Act, December 2nd, 1907, being date of application in Sweden.) December 2nd. (Complete.)

26,087. "Improvements in trolley wire suspension." B. KAY. December 3rd.

26,088. "Improvements in and relating to machines or apparatus for bending the coils of armatures and the like." M. THIEL. December 3rd.

26,120. "Improvements relating to systems of electrical distribution." R. P. JACKSON. (Date applied for under Sec. 91 of the Act, December 6th, 1907, being date of application in United States.) December 3rd. (Complete.)

26,145. "Improvements in or relating to electric lighting arrangements." E. M. ASHLEY. December 3rd.

26,157. "Combined thermostatic fire alarm and electric bell push." C. S. BULLOCK. December 3rd.

26,161. "Improved method of and apparatus for regulating the voltage and power factor on polyphase circuits." C. V. DRYSDALE. December 3rd.

26,165. "Improvements in choke coils." H. J. BECK. December 3rd. (Complete.)

26,170. "Improvements in induction magneto-alternators." L. J. LE PONTOIS. (Date applied for under Sec. 91 of the Act, July 11th, 1908, being date of application in United States.) December 3rd. (Complete.)

26,179. "Multiple anode electrolytic detector." R. J. B. HIPPISLEY. December 3rd.

26,198. "Improvements in and relating to alternating current dynamo-electric machinery." THE LANCASHIRE DYNAMO AND MOTOR CO., LTD., A. P. WOOD and R. S. MCLEOD. December 4th.

26,205. "Detachable lock for bayonet catch electric glow lamp holders." C. F. H. BAYLY. December 4th.

26,223. "Apparatus for starting and governing electrically-driven ring-spinning frames." AKT.-GES. BROWN, BOVERI & CIE. (Date applied for under Sec. 91 of the Act, January 13th 1908, being date of application in Germany.) December 4th. (Complete.)

26,232. "Improvements in and in the manufacture of the junction and other fittings of metallic conduits for electric conductors." C. H. PUGH, LTD., and G. F. BULL. December 4th.

26,233. "Improvements relating to metallic conduits for electric conductors." C. H. PUGH, LTD., and G. F. BULL. December 4th.

26,239. "Improvements in electric clocks." T. J. MURDAY. December 4th.

26,251. "Improvements in electrical fuses." A. WEST. December 4th.

26,252. "Improvements in resistance grids for electrical purposes." A. WEST. December 4th.

26,274. "Improvements in and relating to safety devices for polyphase current machinery." J. M. S. FONTECHA. December 4th.

26,283. "Improvements in and relating to electrically driven rotary brushes." THE LIGHT ELECTRIC MOTOR CO., LTD., and G. F. HIGGINS. December 4th.

26,285. "Improvements in and relating to electric batteries." H. DE MARTIS. (Date applied for under Rule 13, February 18th, 1908; an invention comprised in Application No. 3,671 of 1908, dated February 18th, 1908.) December 4th.

26,287. "Improvements relating to incandescent electric lamps." BRITISH THOMSON-HOUSTON CO., LTD. (Allgemeine Elektricitäts-Ges., Germany.) December 4th.

26,315. "Improvements connected with telephone instruments." P. B. CLARKE. December 5th.

26,356. "Improvements in or relating to electric furnaces." C. BINGHAM. December 5th.

26,359. "Brake for electro-motors." A. HAHN. December 5th.

26,363. "Improvements in the distribution of energy by interrupted continuous currents." E. VON LEFFEL. December 5th.

26,367. "Improved means for closing electric battery cells and for securing electrodes in the same." THE NEW IGNITION SYNDICATE, LTD., and H. FOSTER. December 5th. (Complete.)

26,374. "Improvements in arc lamps." W. N. JOPLING. December 5th.

26,385. "Improvements in and relating to electric signalling apparatus particularly adapted for ships." C. S. BULLOCK. December 5th.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. THOMPSON & Co., 322, High Holborn, W.C., and at Liverpool and Bradford, price, post free, 9d. (in stamps).

1907.

MANUFACTURE OF FILAMENTS FOR ELECTRIC INCANDESCENT LAMPS. "Z" Electric Lamp Syndicate. (H. Zerning.) 20,223. September 10th.

CONTROL OF ELECTRIC MOTORS. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges., Germany.) 22,131. October 7th.

PREPAYMENT ELECTRIC METERS. E. Schattner and R. Amberton. 23,450. October 23rd. (Post-dated March 17th, 1908.)

MAGNETIC COUPLET TO BE WORN ON THE FINGER OR ON OR IN PROXIMITY WITH OTHER PARTS OF THE BODY, FOR THE ALLEVIATION OF RHEUMATISM AND FOR OTHER CURATIVE PURPOSES. E. Brown and J. Cameron. 24,567. November 6th.

ELECTRICITY MEASURING INSTRUMENTS. T. E. Slaughter and H. T. Harrison. 24,894. November 9th.

DYNAMO-ELECTRIC MACHINES. Felten & Guilleaume Lahmeyerwerke Akt.-Ges. 25,309. November 14th. (Date applied for under International Convention, November 14th, 1906.)

INCANDESCENT ELECTRIC LAMPS AND THEIR FITTINGS. J. H. Collings and H. Hirst. 25,815. November 21st.

ELECTRICAL SWITCHES. C. J. Turner. 25,959. November 23rd.

ELECTRIC HEATING APPARATUS FOR WATER AND OTHER LIQUIDS. J. W. Ewart. 27,171. December 9th.

STORAGE BATTERY PLATES. A. C. Tate. 28,132. December 20th.

FIELD MAGNETS FOR OBTAINING RAPID EXCITATION FOR THE DYNAMOS OF PETROL-ELECTRIC AUTOMOBILES AND FOR OTHER PURPOSES. W. A. Stevens. 28,488. December 27th. (Post-dated June 27th, 1908.)

1908.

SPARKING-PLUGS FOR EXPLOSION MOTORS. E. Mooren. 15,875. July 25th. (Date applied for under International Convention, July 29th, 1907.)

ELECTRICALLY-CONTROLLED RAILWAY SIGNALS. Siemens Bros. & Co. and L. de M. G. Ferreira. 20,601. September 30th.

TELEGRAPHIC TRANSMISSION OF PHOTOGRAPHS AND THE LIKE. F. Wyndham. 1,208. January 18th.

ELECTRICITY METERS. Chamberlain & Hookham, Ltd., and S. H. Holden. 1,503. January 22nd.

ELECTRICALLY-CONTROLLED LIFTS, HOISTS, CRANES AND THE LIKE. E. Chaudoir. 2,074. January 29th.

ELECTRIC INCANDESCENT LAMPS. Cutler, Wardle & Co. and W. Wardle. 2,103. January 30th.

MAGNETIC SEPARATORS. L. S. Burt. 2,498. February 4th.

HOLDERS FOR ELECTRIC INCANDESCENT LAMPS. F. W. Suter. 4,608. February 29th.

APPARATUS FOR PLOTTING RESONANCE CURVES FOR DETERMINING THE DAMPING AND FREQUENCY OF ELECTRIC OSCILLATIONS, APPLICABLE ALSO IN TRANSMITTING SYSTEMS FOR WIRELESS TELEGRAPHY. O. Scheller. 4,844. March 3rd. (Date applied for under International Convention, March 4th, 1907.)

AUTOMATIC ELECTRIC WINDING OR DRIVING APPARATUS FOR CLOCKS AND THE LIKE. Firm of One-Year Electric Clock Co., Grundke and Lazarus. 4,867. March 3rd. (Date applied for under International Convention, March 4th, 1907.)

ELECTRODES FOR ELECTRIC WELDING, SOLDERING OR BRAZING. G. Harrison. (Electric Railway Improvement Co., United States.) 5,017. March 5th.

FILAMENTS FOR INCANDESCENT ELECTRIC LAMPS. British Thomson-Houston Co. (General Electric Co., United States.) 5,416. March 10th.

DYNAMO-ELECTRIC MACHINES FOR THE PRODUCTION OF CONTINUOUS OR ALTERNATING CURRENTS. J. Schurch and G. Himmel. 5,691. March 13th.

MEANS FOR ADJUSTABLY CARRYING SHADES FOR ELECTRIC AND GAS LAMPS. E. A. Showell and E. H. Harris. 5,708. March 14th.

ALTERNATING ELECTRIC CURRENT RELAYS. J. D. Taylor. 5,859. March 16th. (Date applied for under International Convention, April 18th, 1907.)

ATTACHMENT OR APPLIANCE CONNECTED WITH THE MOUTHPIECES OF TELEPHONES, SPEAKING TUBES AND THE LIKE. A. Weintraud. 6,547. March 24th.

ARMOURING FOR INSULATED ELECTRIC CONDUCTORS. W. E. Lake. (P. Schroder, Germany.) 9,077. April 25th.

SWITCH ARRANGEMENTS FOR STARTING ELECTRIC MOTORS. Siemens Bros. Dynamo Works, B. G. Payne and E. Schupp. 11,512. May 27th.

ELECTRICAL HEATING APPARATUS, ESPECIALLY APPLICABLE TO FLAT-IRONS AND THE LIKE. W. Eastman and A. Warne. 12,275. June 5th.

ELECTRIC ARC LAMPS. J. O. Girdlestone and C. F. G. Thorkelin. 12,644. June 12th.

MANUFACTURE OF PLASTIC MASSES OF OXIDE OF TUNGSTEN. C. Trenzen. 14,850. July 13th. (Date applied for under International Convention, July 12th, 1907.)

SHADE DEVICES FOR ELECTRIC LAMPS. C. W. Frauenlob. 15,994. July 28th.

TELEPHONE INSTALLATIONS. Siemens & Halske. 16,096. July 29th. (Date applied for under International Convention, August 2nd, 1907.)

INSULATED JOINTS FOR RAILWAY RAILS AND THE LIKE. B. Wolhaupter. 17,493. August 20th.

ELECTRIC HEATING DEVICES. British Thomson-Houston Co. (General Electric Co., United States.) 18,458. September 2nd.

COMMUTATING POLES FOR DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. (General Electric Co., United States.) 18,461. September 2nd. (Application for Patent of Addition to No. 5,741/07.)

MANUFACTURE OF MAGNETOS. H. Stephens. 18,880. September 8th.

REPULSION ELECTRIC MOTORS. Siemens Schuckertwerke Ges. 19,889. September 22nd. (Date applied for under International Convention, September 28th, 1907. Request under Sec. 19 not granted.)